August 1955

Agriculture

VOL. LXII - No. 5

Beef cattle

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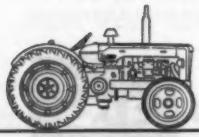

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Cover Photograph

Brecon beef—yearling Hereford bullocks, attested and dehorned

AGRICULTURE

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BRIGHT PAVILIONS

S. R. O'HANLON, M.B.E.
Editor, Agriculture

HIGH summer came to Wollaton Park, Nottingham, for the 107th show of the Royal Agricultural Society of England. Seen from the eminence of Wollaton House, the biggest show (166 acres) ever to be staged by the Society appeared as a pulsating pageant of colour, bathed in a sunshine which evoked a thousand winking reflections from the bright pavilions. Here, framed by a cool perimeter of trees, was a town in miniature; a town of white tents and marquees, and colourfully decorated timber buildings graced by flowers and bedecked with flags; a town which, calling for immense organization and over two years of planning, had taken ten months to build, now had a lease of a mere four days to run. The restless kaleidoscope of the thronging avenues, the rainbow-hued machinery lines, the dark ribbons of sleeper paths, the grass here dappled in shade and there bright in the hot sun—this was the old familiar pattern yet never twice quite the same. In the mosaic of an agricultural show there is a character quite unlike any other spectacle in the world—and the Royal is royal indeed.

Something of the vast scale on which a modern Royal is conceived may be gauged from the following. The dismantling and transport of buildings and shedding from Windsor Great Park, where the show was held last July, was started in September and took a thousand railway wagons. Thirty-five thousand railway sleepers were laid to make weatherproof roads. The electricity supply, carried by 55 miles of wiring, was equivalent to that for a town of 5,000 inhabitants. Water, the most vital of all, required 15,000 feet of water mains and 30,000 feet of copper tubing, providing a peak consumption of 18,000 gallons an hour. The new, all-metal grandstand had accommodation for 7,000 people. Some 150,000 sq. yards of canvas were needed for the tents, and it is estimated that about 20 tons of nails and over 400 gross of screws were used in the erection of the various buildings and other structures. Estimates of the food and drink consumed are not available, but the former must have been mountainous and the latter sufficient to float several Cunarders! About 12,000 people, including exhibitors, attendants and officials, were called upon to staff the show. The total cost was in the region of £165,000—roughly £1,000 an acre.

The interest of the Royal family in Britain's premier show was well marked and greatly appreciated. The Queen, accompanied by the Duke of Edinburgh, came on the second day; the Princess Royal and the Duke and Duchess of Gloucester on the first day. This was the fourth time that the Royal has been held at Wollaton; the first in 1888, when the total gate was 148,000. The figure this year was 185,527. Overseas visitors numbered some 2,000, from 54 countries, and included the Ministers of Agriculture for Canada, India and New South Wales, an official party of twenty Russians, the guests of the *News Chronicle*, led by Mr. Ivan Benediktov, Minister of State Farms, and a private party of seven Russians.

So much to see, so little time, is perhaps a not inapt adaptation of Cecil Rhodes' remark in another context. A visit *every* day was the minimum to do full justice to this show. That the quality and ingenuity of British agriculture were seen to such good advantage, is due to the enthusiasm and indefatigable labour of the Society's Secretary, Alec Hobson, and his team of helpers, known and unknown. To them the credit for yet another memorable occasion.

SOME OBSERVATIONS ON THE PRODUCTION OF BEEF

W. R. T. BUCHAN

Cherington, Stroud, Glos

Mr. Buchan, who is farming 630 acres on the Cotswolds, favours the Hereford-Shorthorn cross for beef production under his conditions. Grass silage from well-managed pastures and kale are notable key foods on his farm.

THE production of beef in this country will have to come in the main from two sources—the larger farm capable of carrying at least one hundred head of stock, excluding calves, with some cereals and other crops, and from farms with a quicker cash product such as milk. Here the beef enterprise would not have to carry the farmer but would increase the profit, and it is probable that this second source would supply most of the calves and store cattle for beef.

The practice of using beef bulls on part of the dairy herd appears to be on the increase, and this is certainly one way of producing more beef cattle without having to increase the number of dams first. The selection of the breed of bull should depend on the breed and strain of the dairy herd. In my opinion, the craze for white-faced calves tends to obscure the fact that certain breeds do not "nick". Most Ayrshire herds, for instance, will produce better calves from a Beef Shorthorn bull than from a Hereford. They might not sell so well as stores in the West of England, but here it is better that all crosses from Ayrshires should be fattened off on the farms that reared them. Channel Island breeds and their crosses are unsuitable for beef production, and if they must be crossed with a beef bull the calves should be sold for veal.

It is difficult to see how beef can replace milk on the smaller farms, for the farmer who keeps about thirty cows and proposes to change over to fifty or sixty bullocks would find it hard to maintain the standard of life to which he has become accustomed.

Prime Beef requires a Good Beast Much more beef could be produced by the present number of feeders if they could buy sufficient stores of the right type. It would pay many of our rearers to study our local store market and ponder why some lots make up to £20 per head more than others of the same age.

First of all, there is the breed and its crosses. There is no doubt that there is an affinity between a breed of cattle and the area in which it originated. The best types of the breeds, and I think most profit for feeding them, are found thus:

Angus in Angus, Aberdeenshire and adjoining counties;
Galloway and its blue-grey cross in Cumberland, Dumfriesshire and Kirkcudbrightshire;
Lincoln Red in Leicestershire and Lincolnshire;
Sussex in Sussex;
South Devon in Devon, and
Hereford in the West of England and Wales.

So far as the Cotswolds are concerned, I doubt whether there is any breed which will give better results than the Hereford-Shorthorn cross, which combines a hardiness for outwintering and an extremely good growth factor for the production of beef at an early age.

Then there is the calf. Calves for beef require better feeding for the first year than calves for milk. We have heard a good deal within recent years of the value of rearing these calves on a high plane for the first eight months. In my opinion it is debatable whether the period should be limited to eight months if the calves are born in the spring, for this implies that a reduction in the level of feeding may be introduced in the autumn, whereas my experience indicates that the first winter is a most important period in a calf's life and that it should be maintained in fleshy condition until it reaches the next grazing season. Where calving dates can be organized, I should prefer to have calves born between September and February. These are ready to take full advantage of their first summer's grass and can be made to produce prime beef at twenty-one to twenty-four months old. If they are sold as stores, the greater care taken in rearing will be reflected in the price.

The buyer of store cattle is certain to take into account weight for age, as this yardstick discloses the breeding, feeding and conversion rate of the animal. It will also take care of the more obvious points of length, breadth, depth and health. Breadth of shoulder is less obvious and is often a weak point with stores bred from dairy cows. The head of an animal discloses much of its past and also some of its future, and these factors do not add to the weight on the weighbridge and therefore the price.

Grass into Beef It has been said that stores brought in from certain counties do not thrive here in Gloucestershire, but this does not appear to apply to any counties in the western half of the country. The more one improves the pastures, the safer it is to bring in cattle from other counties, and, of course, the time lag which usually occurs before there are signs of improvement is correspondingly reduced.

Where stores are to be wintered, one of the most profitable dressings for pasture is 3 cwt. "Nitro-Chalk" per acre in August/September. This gives the cattle a little extra protein to carry them through the winter, and on the Cotswolds, where we have trouble occasionally with grass tetany, I think it is an advantage to alternate the usual high concentrate fertilizer applied in the spring with kainit and superphosphate applied in the autumn, putting on the "Nitro-Chalk" later as required.

Most cattle will react to a flush of grass, particularly if the flush is boosted by fertilizers, and this is a good time to check up on them, for those which have not dried up in two to three weeks should be brought in for dosing with phenothiazine.

When beef stores are wintered on fodder alone, they take a long time to adjust their systems to the spring grass and so miss part of the best growth-producing period of the year. But if they are wintered on succulent foods such as kale and/or silage, they appear to retain much of their inner reserves and are better able to withstand the change to spring grass. It is an advantage to have part of the herd finishing by June, for this provides a safety valve for drought or an opening for silage or hay. This system can be practised along

with winter fattening in yards, so that by overlapping the various bunches of cattle, it is possible for one feeder to have finished cattle ready for sale in small numbers during nearly all the weeks of the year. This gives him a fair average price over the whole of the season.

It might be worth while giving some thought to the cost of making silage in May, which is said to be the best month. I believe that May/June is the best period for animal growth as well as for vegetable growth, and it may pay better to convert this early grass into beef direct; apply 3 cwt. "Nitro-Chalk" per acre, and take a silage cut in July or early August. Even if this does clash with the early barley field, it will not cause so much worry as harvesting a late one.

Where beef production is the main enterprise, it is usual to employ one or both of the following systems:

1. A breeding unit is maintained and the calves are reared right through to the finished beast.
2. Store cattle are purchased at 1½-2 years old.

The first has the advantage that less floating capital is required, there is no necessity to buy when stores are dear, and there is great scope for personal attention, particularly with regard to retaining the calf flesh and turning out a really prime beast of about 10 cwt. at eighteen to twenty-one months.

The second system suits the large farm where labour is scarce and where the farmer has sufficient liquid capital to take advantage of a lull in the cattle market, and has the experience necessary to discriminate between the growthy animal and the one that is unlikely to increase its weight at a profitable rate and fatten at the same time.

A combination of both these methods might well be the best of all where it fits in with the conditions on the farm and the inclination and ability of the farmer, for here there is a greater spread of advantage with a smaller penalty for error of judgment.

Many feeders appear to mix the sexes on pasture, but I prefer to keep bullocks and heifers separate, at least during the fattening period. Bullocks are more easily upset, take longer to forget, and those which develop a roving habit pay little for their keep. Further, bullocks suit permanent pasture or the oldest leys, for their growth is steadier and spread over a longer period, and therefore they fit in better with the slow, steady growth of permanent pasture. Heifers, on the other hand, can match the quick growth of young leys and can be fattened at almost any stage if the pasture is good enough. There is little to choose between heifers and bullocks in profitability. The quicker turnover of a large number of heifers is balanced by the heavier weights of the bullocks, and the deciding factor is which will fit better into the feeder's particular system. For instance, where kale is to be strip grazed, there may be some difficulty in getting bullocks to settle sufficiently to put on weight, but the same management is quite successful with heifers. When these heifers are intended for the fat market, they should be fed some hay along with the kale. In fact, any cattle which are fed on kale or silage are the better for some dry fibre in the shape of hay or straw. How much they will eat depends a good deal on the relative qualities of the foods offered.

The question of quality in beef is rather a moot point at the moment, for the pendulum has swung to the opposite extreme and there is a strong demand for a lean store for killing. Nevertheless, I believe that the few butchers who still prefer to buy a fleshy animal, even if not "ripe" in the pre-war sense, are working in the best interests of their customers and also of the feeders, and it may be that this scramble for lean meat, whatever the

texture or flavour, will result in a shortage to the disadvantage of all; butchers, as well as consumers and feeders.

Home-grown Cereals into Beef Beef production is said to be one of the easy ways of losing money, and the figures published on winter fattening appear to confirm this. There may be room for debate on how much of the cost of home-grown foods would be incurred in any case, particularly where the whole of the staff is necessary for other production lines, but there can be little doubt that purchased concentrates are still too costly for conversion into beef. A daily ration of 10 lb. of feed costing 2*s.* 6*d.* in exchange for 2 lb. liveweight gain, value 2*s.* 10*d.*, leaves faint hope of recovering any part of the cost of bulk feeds, labour, use of capital, sickness and death, and other costs.

The use of home-grown cereals is certainly better than paying cash off the farm; but opinions differ widely on this point. My own is that cereals tend to increase the outer layer of fat if fed in the final stage and, in any case, it usually means that the profit for growing them must be obtained through the animal, and therefore there is a greater risk of losing this profit than where the cereals are sold for cash. There are two instances where I think it does pay to use home-grown cereals. These are:

1. To fattening cattle for the first four to six weeks on silage at the rate of 1 lb. per live cwt. daily. This maintains the animals in thriving condition, while their digestive organs are adjusting themselves to the changed diet. After this period, liveweight gains appear to increase as the season progresses.
2. To stores on dry fodder during March at 3 lb. daily. This ration reduces the loss which would otherwise result from lack of green food, and is amply repaid by weight increase in May and June.

The use of concentrates must, however, depend upon the system adopted by the feeder, and in this and many other directions there is much we have yet to learn.

At any rate, there would appear to be an opportunity offering to rearers and feeders at the present time to fill the gap left by the reduced Argentine supplies. Beef is one commodity for which the penalties of over-production are a long way off.

PROGENY TESTING OF SHEEP

OSCAR COLBURN

Northleach, Glos

Progeny testing is designed to take the guesswork out of breeding. Little has been done in this field with sheep, so that Mr. Colburn's account of the methods he is using at Crickley Barrow is of particular interest.

SOME five years ago, we were considering how to raise output from the grass break in our rotation. It was then that we first decided to "progeny test" our sheep for factors that had a direct bearing on the economics of this livestock enterprise. In any system of fat lamb production, assuming good flock and pasture management, the profitability of the enterprise depends very largely on the prolificacy of the flock and the milking capacity of the ewes. It seemed that as far as these qualities were concerned, sheep

Within these average figures, individual performances varied considerably. Weaning weights of singles varied from 98 to 128 lb. Twins varied from 98 and 99 lb. to 130 and 118 lb. Absolute weaning weights, however, were not the criterion. The important thing was liveweight gain per day, and here again variation was considerable. Single lambs varied from 0.53 to 0.73 lb. per day and twin lambs varied from 0.53 to 0.66 lb. per day.

At that time the price of lamb was very roughly 2*s.* 3*d.* per lb. dead weight. Assuming a killing-out percentage of 50 per cent, with the examples given above, output per ewe varied as follows:

With single lambs—£5 10*s.* 3*d.* to £7 4*s.* 0*d.*
With twin lambs—£11 0*s.* 6*d.* to £13 19*s.* 0*d.*
Difference between the worst single and best twin—£8 8*s.* 9*d.*

Such a margin, which would be magnified as stocking rates increased, seemed worthy of serious attention.

System of Evaluation Having compared a bunch of ewes under identical conditions, it is necessary to be able to record their performance for easy reference later. To do this, we evolved a figure called the "Ewe Index Figure", arrived at as follows:

Total weight of lamb or lambs at birth, subtracted from total weight at weaning. Divided by number of days from birth to weaning, and multiplied by 100 to provide a round figure and emphasize differences.

EXAMPLE EWE 1

Single lamb at birth—12 lb. At weaning—120 lb.
Born April 1. Weaned September 1. 153 days.

$$\text{Index Figure} = \frac{108}{153} \times \frac{100}{1} = 70$$

EXAMPLE EWE 2

Twin lambs at birth—9 lb. and 10 lb.
At weaning—112 lb. and 115 lb.
Born April 4. Weaned September 1. 150 days.

$$\text{Index Figure} = \frac{208}{150} \times \frac{100}{1} = 138$$

The Index Figure, therefore, takes account of both prolificacy and milking capacity. If this figure is then expressed as a percentage of the average index figure of ewes which have reared *twins* (in the same year and under the same conditions), one arrives at a simple and accurate measure of relative prolificacy and milking capacity of the ewes under test.

In the example given above, if the Average Twin Index was 120, Ewe No. 1 would rate at 58 per cent, Ewe No. 2 at 114 per cent. Growth rate is highest in the early weeks and falls as the lambs grow older, of course. Earlier weaning would give a higher Index Figure but would not affect the percentage rating of ewes.

Results of the first year's work encouraged us to proceed further. The size of the recorded portion of the flock has been continuously raised until it now comprises some 270 ewes.

Progeny Testing This system of recording and evaluating ewes was a necessary preliminary to the real object of the scheme, which was to progeny test rams Many sheep breeders say that by breeding only from twins they will eventually raise the prolificacy of the flock. By the law of averages, the number of heterozygotes bred from on such a system must necessarily be high and progress very slow.

We are testing sires for transmission of prolificacy, milking capacity and

had been bred less scientifically than any other animal. Thinking along these lines, we sought to evolve a system of breeding based on full flock recording and progeny testing. In this way it was hoped to raise gradually both prolificacy and milking capacity, and probably growth rate as well.

Very little work has been done in this country on progeny testing of sheep. Elsewhere the work has largely been confined to measuring weight and quality of fleece, and growth rate, transmitted by selected rams mated to ewes *at random*. We wished to measure prolificacy and milking capacity—factors which are controlled by more complex inheritance mechanisms. It was therefore necessary to decide on a simple technique suitable for use under commercial conditions that would yet provide the necessary information. Eventually we wanted to be able to test four or five sires at a time. But before this was possible it was necessary not only to work out a suitable system, but also to find a method of assessing the potentialities of the ewes on which the sires were to be used. Equally, there had to be a similar method of evaluating the performance of the daughters of the sires under test. A fundamental difference between what we wanted to do and what was being done elsewhere was this insistence on using "evaluated ewes", rather than ewes chosen "at random", for the testing of sires.

For some years we had run a flock of Clun ewes on which Dorset Down rams were used for fat lamb production. It was obvious that some did their lambs better than others, but to what extent this was due to hereditary factors we could only guess. We suspected that in a breed such as the Clun Forest with a breed lambing average of about 150 per cent, the average would be made up of ewes which usually had twins, ewes which usually had singles, and the majority which would have singles one year and twins the next. We did not know by how much the best and the worst ewes varied in milking capacity from the average.

To answer questions such as these and eventually to acquire a flock of known individual performance on which the influence of the sires could be accurately assessed, it was necessary to record each ewe. It was hoped that when the capacity of a ewe had been established, it would remain constant, *relative to the rest of the flock*, from year to year. This has in fact proved, broadly speaking, to be true, subject to variation for age, of which a more accurate picture is being built up every year.

Starting a Flock Record In order to become familiar with the problems involved, a start was made in a small way, by selecting from the flock a nucleus of thirty-one ewes. These were chosen for type and, more important, because they had reared good twin lambs in the previous year—as good a selection for performance and type, in fact, as it was possible to do by eye. Each ewe was given an individual ear-mark. They were put together in September. A Clun ram was turned out on November 1 and they were kept under identical conditions until their lambs were weaned. At birth the lambs were marked individually, weighed, and then weighed fortnightly until they were weaned in early September. (As a result of later experience, weighings have been reduced to four only.) Flock management was normal—worm drench in September, flushing for the ram, hay in winter, steamed up with concentrates, worm drench at eight and twelve weeks after lambing.

After taking particular care to choose what was thought to be a bunch of uniformly good ewes, the results were astonishing:

31 ewes to ram, 2 died, 1 barren, 48 lambs tailed
Lambing percentage—154
Average birth weights—Singles: 12.0 lb. Twins: 10.1 lb.
Average weaning weights—Singles: 114 lb. Twins: 107 lb.

Within these average figures, individual performances varied considerably. Weaning weights of singles varied from 98 to 128 lb. Twins varied from 98 and 99 lb. to 130 and 118 lb. Absolute weaning weights, however, were not the criterion. The important thing was liveweight gain per day, and here again variation was considerable. Single lambs varied from 0.53 to 0.73 lb. per day and twin lambs varied from 0.53 to 0.66 lb. per day.

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We are testing sires for transmission of prolificacy, milking capacity and

growth rate. It takes three years to obtain results from any one group of sires. The first year decides merit as far as average growth rate of all their progeny is concerned. (Singles, twins and triplets are compared separately, for various reasons twins giving the most accurate picture.) In the second year, their selected daughters lamb for the first time as ewe lambs. This gives us *some* indication of the sires' progeny, but it is, of course, unreliable. It is only in the third year, when the performance of their daughters is confirmed during the second lactation, that we get a complete picture of the value of the sire.

Home-bred replacements are being brought into the flock at the rate of fifty or more per year. It is felt that the minimum number of daughters of each ram under test should be about 12, so on that basis it is possible to test four rams every year.

The idea of mating the rams under test with ewes at random has been rejected. On the contrary, particular attention is paid to the mating programme and each ram is given equal numbers of ewes in each age group and within each age group equal numbers of ewes of similar known milking capacity. Only in this way can accurate assessment of progeny growth rate be made.

Each ram may produce some thirty or more ewe lambs from the bunch of ewes (about forty) to which he is mated. If only a dozen or so are required to come into the flock for testing, they are not selected at random, but care is taken that daughters of each ram are chosen as far as possible from ewes of equal known performance. It is true, of course, that inheritance through the female line is variable. However, it is felt that with a minimum of twelve daughters, and preferably more, the system is accurate enough to show up a really good sire, and will tend to become more accurate as time goes on and family histories become established.

When evaluating the daughters of a group of rams, it is important that they should be kept under identical conditions from before flushing in preparation for service until their lambs are weaned. In theory, they should all be served by the same ram, but where numbers are too large for that, the next best solution seems to be that they should be equally divided among rams of known relative growth rate of transmission, and the necessary corrections made. This sounds complicated, but in fact a supply of suitable rams which would otherwise be discarded is almost a by-product of the system.

Where prolificacy is concerned, it is accepted that flushing the ewes for the ram can have an important influence. Without going into details of management, it is sufficient to say that every care is taken that ewes being compared are flushed equally as far as possible.

Flock Organization Some of the problems of flock organization with such a system on a commercial farm now become apparent. Here at Crickley Barrow, to suit our field sizes and general farm administration, it is convenient to run the flock in three bunches during the summer. In the course of its life, each breeding female passes in succession through each bunch. It spends two lactations in the first, three lactations in the second, and the rest of its life in the third.

The first bunch consists of *daughters* of the sires under test. The second bunch consists of ewes to which the sires under test *are being mated*. The third bunch consists of ewes which, having passed through the other two bunches where their performance has been established, can be used, in selected cases, for individual matings to produce rams. They can also now

be used for research on other factors, since the basic economic factors of prolificacy and milking capacity have already been established.

It is necessary to describe in more detail the functions of the first two lots of ewes. The first consists of first lactation ewes (ewe lambs) and second lactation ewes, each lot, as described above, being *daughters* of a group of rams under test. Their lambs are marked at birth, weighed, and then weighed at intervals until weaning, when they are sold. On the basis of their daughter performances in this bunch, plus growth rate which is already known, the best sire is chosen from the group under test, and then some of his sons out of the best available ewes make up the next group of rams for testing. Equal flushing of this group of ewes in very important.

The second bunch consists roughly of third, fourth and fifth lactation ewes. We already have a fairly good idea of the performance of these sheep, and it is this bunch which is *mated* to the group of rams under test in any given year. It is here that care is taken that each ram is given equal numbers of ewes of equal capacity in each age group. At tupping time the ewes are divided according to the number of rams, flushing as far as possible being equal. As soon as the rams are taken up, they are brought together again and are kept together until the lambs are weaned. It is in this bunch of ewes of known capacity that growth rate transmitted by the sires is assessed. It is from this bunch that replacements of ewe lambs are drawn to come into test the following year. Wether lambs are castrated in the normal way and sold at weaning. All lambs are marked at birth and weighed at the necessary intervals.

As described above, results from any group of sires under test come every third year. For various reasons it has been decided to keep three lots of sire groups going all the time, so that a result from one of them comes every year. Each group will be compared only within itself and not with the others.

With a flock of this size, a breeding programme as described means keeping a lot of rams, since none can be discarded for three years after they have been used. By the kindness and co-operation of several friends, it has been possible to send the surplus rams out to farms where they can be kept in regular work until their performance is known.

Conclusion A by-product of this system of recording has been an increased knowledge of sheep generally. An interesting picture is being built up of mortality rates and causes at different ages under commercial conditions. Although no critical work has been done, there are indications that some strains are more susceptible than others to foot rot. This may well hold true for other ailments also. Some of the factors governing conception rates in ewe lambs may be revealed over a period of years. There is at least a suspicion that some families are more tolerant of intensive stocking rates than others—a most important thing under modern conditions of grassland management. It is certain that there are many problems on these lines awaiting serious research.

In this short outline, it is obviously impossible to examine all the implications of this system of breeding sheep. It is felt, however, that breeding methods which have proved adequate in the past must now give way to methods on lines similar to those we are attempting, if the progress so far made in this country is to continue.

INTENSIVE MILK PRODUCTION ON THE SHROPSHIRE-CHESHIRE BORDER

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MUCH has been written about the high intensity of dairy enterprises and their future outlook. It is a question of putting all available resources into one main aspect of farming and concentrating on this, other sidelines such as pigs and poultry being secondary considerations. The intensity of milk production on the farm which is to be described is very high, and over a considerable number of years the management has proved to have been extremely successful. Costs are high, output is high, and so also is the profit.

A Dairy Enterprise The farm is situated in north-west Shropshire and is rather exposed at an altitude of 400 feet. The farmers —Messrs. F. and P. Arthan of Pentre Morgan, St. Martins, have farmed here for many years. It is one of the traditional border dairy farms, where milk production is the main source of income. The soil conditions vary from a medium to a heavy loam, which makes poaching in winter very bad, and conditions in time of wet weather extremely difficult. Figures from a group of similar farms obtained from the Farm Management Survey carried out by Manchester University are used for purposes of comparison. This group comprises farms of 150-200 acres.

Alternate husbandry is practised on this farm, the rotation being: corn—kale—corn and seeds—5-year ley.

Each year some 40 acres are in cereals and 20 acres in kale, which are strip grazed. Ten acres of this kale are transplanted in early spring and 10 acres are transplanted later on a portion of a field which has been used for an early bite, followed by a cut for silage or dried grass.

The transplanting of kale is, however, absorbing too much labour at a time when it is most wanted for grass drying or silage-making, even though this present system demands less labour than the usual system of sowing in rows and singling. To cut costs to a minimum, consideration is therefore being given to a short fallow followed by broadcast kale. It may be that this method will give a lower yield of kale, but it will enable other valuable crops on the farm to be secured in better condition with the labour available.

Long leys have been found to be the most suitable, and leys such as timothy/meadow fescue; cocksfoot/white clover; S.23 perennial ryegrass/white clover; lucerne/timothy, and Cockle Park mixtures, all have their place on the farm. Strip grazing is alternated with cuts for hay, silage or dried grass. The aim is, therefore, to make each ley field produce three cuts or grazings per year.

Various methods of obtaining an early bite are used: sowing Italian ryegrass under corn and top-dressing for an early bite in the succeeding spring, or sowing rye after corn in August, which is used for early bite in the following year, then top-dressed for a cut of silage, ploughed up and machine-transplanted to kale. By this method, an average yield of about 25-30 tons of kale per acre is being obtained.

The July-August gap is filled by reseeding direct each year some 10 acres, in addition to fields cut for dried grass or silage and laid up until required.

The Herd The herd consists of pedigree and grading-up attested Friesians, and is entirely self-contained; no females have been brought into the herd for over thirty years. The cows themselves average about 10-11 cwt. and are good, strong-bodied Friesians with a long life. Messrs. Arthan's aim on this farm has been to breed cattle that will produce a high milk yield and live a long life, and anyone seeing and knowing the herd would agree that this has been accomplished.

There are a fair number of cows in the herd in their eighth and ninth lactations. The main practice is to sell unwanted calves from lower yielders at birth, and to keep the remainder for replacements and for sale as calving heifers. The herd has been free of disease for many years. The official herd average yield for the year ended September 1953, was 10,203 lb. for cows, and 8,152 lb. for heifers, and by September 1954, had increased by 767 lb. to 11,071 lb. for cows, and by 1,969 lb. to 10,121 lb. for heifers.

It is of interest to note that these heifers never gave a very high peak milk yield, the average being only 40 lb. and the highest 48 lb. But they maintained this level of production for a considerable time. Thirty weeks after calving, they were averaging 30 lb. of milk a day. Also, most of the heifers calved in the autumn, so that their total output of milk was obtained equally from winter feeding and summer grazing. Thus it was possible to reduce winter milk production costs by the feeding of more roughages, such as hay and kale, and less purchased feedingstuffs.

The density of stocking per 100 acres is high: 43 cows and heifers in milk, 17 heifers in calf, 2 bulls, 18 one- to two-year-olds, and 19 calves, making a total of 99 head of stock. All cattle are maintained on the farm, and none are sent away on agistment.

Feeding the Cows Winter milk production is the main aim and is assisted by early bite and autumn grazing; fields, as already mentioned, being laid up for this purpose. When the grass is finished towards the middle or end of October, depending on seasonal conditions, kale is fed and lasts until mid-January; thereafter the stock goes on to dried grass and silage. All cows go out to graze kale during the winter, no matter how high their individual yields. This method is adopted even for cows giving 8-10 gallons. It is reckoned that they consume some 60-70 lb. of kale a day on an average. From the farm, therefore, maintenance and one gallon is obtained during the winter. Concentrates are fed for the remaining gallonage.

The production ration is composed of home-grown cereals plus high protein cakes, and is fed at 4 lb. per gallon. For higher yielding cows, (i.e., after the first 4 gallons), a proprietary balanced ration is used. The cost of the production ration last winter was 1*s.* 1*d.* per gallon.

Intensive Grassland Management It is evident that a high degree of skill is required to maintain such a large head of stock, to provide sufficient keep all the year round and to maintain an efficient economic output from year to year.

To obtain such a high output from grass, it is obvious that special consideration must be given to the manuring of the grassland, not only to get production for one year but to maintain that production over a period of years. It has been found that the potash requirement of the soil must be watched closely, and 2 cwt. muriate of potash is applied approximately every other year, or every year if necessary. Basic slag is applied every three years to the leys. About 2 tons ground limestone is applied every five years. In addition, the leys each spring receive 3 cwt. of a highly concen-

trated complete fertilizer, followed by 2 cwt. "Nitro-Chalk" per acre for each cut or strip grazing, as the case may be.

High output from grass, therefore, has been achieved only by the liberal and efficient use of fertilizers. £5.31 per acre was spent in 1953-54, as compared with £1.9 per acre on comparable farms in the same year.

The Economic Situation Turning to production, we find that the gross output on this farm was £82.3 per acre in the year under review, which is £33.2 per acre more than the group of farms mentioned earlier as the basis for comparison. This high output was of necessity followed by fairly high costs of £63.3 per acre, which gave a net farm income of £19 per acre, so comparing extremely well with the group average of £8.9 per acre.

We find that the greatest proportion of this output came from livestock products, meaning that most farm produce is sold through the livestock. For instance, the milk sales off the farm amount to £70 per acre, or 85 per cent of the total output; with sales of young stock and cows at 12.5 per cent, the pig and poultry production play a very small part. The actual production in gallons per cow during the financial year April 1953-March 1954 amounted to 1,000 gallons, which accounts, of course, for the very high output figure.

Output and Costs

	Farm	Group Average
	£	£
Output per acre	82.3	49.1
Costs per acre	63.3	40.2
Net farm income per acre	19	8.9
Output per £100 costs	130	123
Output per £100 labour costs	655	475

So far we have considered only output; let us now consider costs, and how they fit into the picture. It is found that output per £100 costs was £130; that is, £30 was available as a return for management and capital invested in the farm, which again compares very favourably with £23 for the group of similar farms.

Labour output is high—£655 per £100 labour cost, which points to good organization and output per man, in spite of the fact that a considerable amount of overtime is worked, not only with the dairy herd at weekends but also in summer during the grass drying season. This latter operation has been streamlined so that only two men are required—one cutting and carrying and the other operating the drier. Drying starts at 7 a.m. and goes on to 9 or 10 p.m. during the flush season. Sufficient grass is brought in during the afternoon to leave only one man at the drier during the evening.

A considerable acreage of the grassland is devoted to the production of dried grass, which plays a large part in winter milk production. One hundred tons is made and baled each year. The protein content has been in the region of 15-17 per cent, but investigations seem to show that it could possibly be more economic to produce less high quality dried grass and more grass of super hay quality to maintain the young stock and dairy cows. This, together with wilting, would increase output through the drier during seasonal flushes, and cheapen production. Silage is also made as a complement to dried grass when excessive growth demands. The cost of drying the present quality of grass has worked out at around £17 per ton.

The actual number of men on the farm was five, excluding the farmer. This gave a labour cost of £10.2 per acre and compares favourably with an

average for the group of £10.5 per acre, where output, costs, and net incomes are much lower.

It may be contended that these costs are high, but so also is output, and it is very difficult, if not impossible, to find farms so intensively farmed as this one, without high costs. The ratio of costs to returns is the important item in this case. Labour, power, and feedingstuffs have all been efficiently used and managed to give a very high return. For instance, feedingstuffs bought on this farm amounted to £28.7 per acre, but this high figure was justified by the quantity of milk produced—1,000 gallons per cow. In comparison with the group average, we find 686 gallons per cow with £16.5 per acre of bought feedingstuffs.

Farm management analysis figures have been worked out on this farm for the last three years, and comparison figures are interesting in that by attention to detail and correct deployment of the various resources of the farm, it has been possible to increase production without materially increasing costs. It is often forgotten that many costs on a farm, such as rent, rates, labour, and machinery, are static.

On this farm we find that the gross output figure has risen by 13½ per cent, with only a small corresponding increase in costs of 3½ per cent. This has been brought about by an increased use of feedingstuffs as far as costs are concerned, and the output increase has come from increased milk yield per cow, showing the profitable use of more feedingstuffs.

Attention to Detail Pays In conclusion, it will be seen that the success of this enterprise has been brought about by a number of means. A high stocking density has been possible by intensive grassland management, high milk output by economic conversion of the grassland products and purchased feedingstuffs, together with a healthy, low replacement rate herd. Attention to breeding and buying the right sires has undoubtedly had a marked influence. The management of labour, the attention to detail, and the willing co-operation of the workers have all contributed to this high output. The farmers have, in fact, continually kept in mind the farm as a whole, and the steps taken to improve the enterprise have been well co-ordinated. Cropping has been fitted to the stock and to the labour supply, and improvement of crop productivity has gone hand in hand with increases in stock numbers and with improvement of the quality of the stock. Feedingstuffs have only been bought and used to supplement farm supplies so long as they produced an economic return in milk. The aim has been to make the most of the factors of production which are scarcest—labour and land. The result has been a high output per acre and per man, and a high profit.

The writer would like to express his appreciation and thanks to Messrs. Arthan for their willing co-operation in providing the necessary financial details; also to acknowledge the help he has received from the Agricultural Economics Department of Manchester University.

CATTLE DROVING FROM WALES TO ENGLAND

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Over many centuries the old droving roads have brought beef and milk from Wales to England on the hoof. By keen research and conversations with people who can still remember the droving fraternity, the author has pieced together a valuable historical picture.

WALES has always been pre-eminently a stock-rearing country, especially of cattle. The laws of Wales, given by King Howell Dda in 900, afforded great prominence to cattle, and Welsh princes and chieftains valued their estates in the amount of cattle they held. Before 1253, Welsh cattle were being driven some distance into England, and a regular trade in them was also set up at Newent, Gloucestershire at a yearly fair and weekly market established in that year.* Edward II ordered Welsh cattle to be collected for his English troops in the Welsh wars. But probably the first really big venture in cattle droving from Wales to England was in the time of Henry V, who ordered as many cattle as possible to be collected in Wales and driven to the Cinque Ports (which then included Brightlingsea in Essex). Here they were to be fed fat to supply his armies in France, in his long campaign to conquer that country.

About 1560 an era of prosperity came to England and a demand sprang up for fat beef. This was satisfied by driving large numbers of cattle from Wales (as well as imports from Ireland and droving from Scotland) to be fattened on the Leicestershire pastures, the Lincolnshire marshes, and in Kent and the Home Counties. The cattle were bred in Wales but could not be fattened there, since there was neither enough suitable land for them nor a population wealthy enough to buy fat beef. To start with, these cattle were of various colours and mixed breeds, but in the course of time the most noted breeds became the Black Castle Martin of South Wales and another type of black cattle in West and North Wales. Besides their value for beef, these breeds were also noted for milk and cheese production, and a trade in milch cows to England also developed.

The cattle were small (4-5 cwt.); the bullocks 4-5 years old. It was not until the era of good farming and winter fodder, from 1800 onwards, that the size increased significantly. But the animals improved in weight during their 200-240 miles journey from Wales to England. From 1600 onwards, as many as 30,000 Welsh cattle were being driven every year over various routes to the east; of these, one-third passed through Radnorshire. The meat was tough and coarse and the fat was laid on in lumps. But this did not matter, since tallow chandlers bought the fat for making candles, and the growth of big houses in Georgian times increased the demand for candles considerably.

Routes from Medieval Times This article deals with the routes from Cardiganshire to England, with particular reference to that county and Radnorshire and Herefordshire. It is based almost entirely on hearsay—that is from persons who have met and con-

* An Early Reference to the Welsh Cattle Trade. H. P. R. FINBERG. *Agricultural History Review*, 1954, **2**, 12-4.

versed with people who were living in 1850 or earlier. They had therefore seen the droving, had been drovers themselves, or had talked to them.

South Wales cattle went through Glamorganshire, and cattle from N. Wales took a route through Montgomeryshire and Shropshire, with part of its way through N. Radnorshire. These routes existed from medieval times until 1870, when the last cattle came from Aberystwyth to Hereford. The advent of the railways soon put a stop to droving and there was not much after 1853. (It must be remembered that railways were instituted in 1832 principally for the carriage of goods and livestock, not for passengers.) But the droving of Welsh mountain draft ewes for English farmers in Middlesex did not cease until 1900. This trade had sprung up about 1820, prior to which there was no trade in draft ewes, as sheep were kept in Wales for their wool. Covering the Welsh hills were prehistoric and pack-horse tracks and some Roman roads, many of which were used as cattle drove roads. Later the coach roads were sometimes used, provided the toll gates could be avoided. The latter were numerous; they charged 3*d*. per beast and 1*d*. per head for sheep—an expensive matter on a long journey. A gate also took up much valuable time. Toll gates and Turnpike Trusts date from about 1756, and those at Kington, in Herefordshire, were not abolished until 1893. By this time the new Macadam roads were introduced. These were too hard for the hoofs and caused more lameness than when all the routes were soft.

In 1632 a "murrain" attacked all Welsh cattle and none were driven to England that year. They were supplanted by imports of Irish cattle. But at the end of the reign of Charles II importing Irish cattle was prohibited altogether. Before the Enclosure Acts of 1810 (onwards) most of Wales and all Radnorshire and Herefordshire had been "open" country without hedges and boundaries. This greatly simplified the routes, and so one finds almost dozens of drove tracks leading in the same direction. Even today on the Radnorshire "open common hill runs" one sees—and can still use—a diversity of tracks, all leading in the same direction. Many of these were used by the old drovers. As enclosure came, some of the routes had to be modified. When toll gates were introduced some of the former routes were turned into coach roads and ceased to be used for the cattle traffic.

On the Road The essentials for a cattle route were: plenty of grazing and drinking water; a route dry underfoot in all weathers and one not passing through marshes or flooded areas or areas liable to flood; and yet one which was fairly direct so that the cattle might get to their final markets as quickly as possible. A day's journey was usually 12-14 miles, which allowed ample time for grazing and resting on the way. Often this meant a three weeks' journey. In bad weather a flooded river might delay fording for two or three consecutive days. This hold-up cost the drover money as well as time, and he might not succeed in getting to the fair in time to sell his beasts. So he chose a route best suited to the prevailing weather. It might not be the shortest, but it was the driest, with the easiest fords if the weather was bad.

The most general droving took place in April for dairy cows and heifers. These cows were very popular in Lancashire and Cheshire dairies, and sometimes, therefore, they were diverted from the east and south-east of England. The great months for droving store cattle (for fattening) were September and October, and often they were stormy and wet. The beasts were all shod or "cued" before the start of the journey and as many times as necessary during its progress; this might be quite frequent and it was one of the main expenses, as the four hoofs cost 1*s*. to shoe. The "cues" were made of disused pony shoes, cut in half and nailed on either side of the "split". Shoeing was a

very skilled matter. The animal had to be thrown and kept down on the ground whilst having its "cues" nailed on, so entailing very strong men—and, it seems, the drinking of a good deal of cider or beer during the operation! This held up the progress of the journey, so special smithies were erected at suitable points along the main drove roads. The sites of most of these are known, but the buildings themselves have long since gone. Some of them were situated close to the farm where the animals were penned or folded for the night, others just on the route, nowhere near the night's resting place. Many fields are still known as "Blacksmith's Fields" and their fertility is great, even now.

Cider was introduced into Brecon from Herefordshire about 1600, and was just as popular as beer with the droving fraternity. About 1800, cider houses were erected at many points along the routes—solely to cater for the droving trade—and they did a thriving business.

At certain rivers, such as the Wye at Erwood, the river was usually swum by the cattle, the drover guiding them across from a boat, for the Wye is usually very deep there and can be very dangerous. The boatman charged one shilling for his services.

A Profitable Trade The system of droving was for a capitalist drover (often a farmer) to buy a large troop of cattle at Welsh fairs, mainly at Ffair Rhos and Tregaron, and latterly at Aberystwyth, and to employ paid labour to drove them to their destination. From about 1800 to 1850 the usual wage was 10*s*. per week, and all expenses paid. This was a more attractive sum than the agricultural labourer could earn, and so there was no lack of applicants. They were a rough and often rather drunken crowd, but they rarely let their employers down and usually got their troop through to their English destinations in safety.

The employer rode behind his troop of cattle the day after, and himself paid the expenses incurred by his employees who had stayed at the cider houses or agreed farms. The employees were pure Welsh speakers, and the only English they could manage was the one sentence: "Master will follow tomorrow and will pay".

From the beginning of the eighteenth century, farmers willing to put up this trade for the night planted clumps of from three to five Scotch fir trees at a high point, close to the farmhouse, which were visible from afar. When a drover saw these clumps, he knew he was on the right road or near a night's resting place.

The trade on the whole was profitable and averaged £3 clear profit per bullock from 1800 to 1850, although sometimes there were reverses, as in 1805 and 1815. The last man to use any drove route through Wales bought 100 Hereford bullocks at Aberystwyth in 1870—a slump year—and took them to Hereford and there sold them at £1 per head profit. He took a week on the journey. But the last droves of draft Welsh mountain ewes passed through Colva and Gladestry from Tregaron, on the way to Harrow-on-the-Hill (Middlesex), in 1900.

The capitalist drover was a responsible individual and several of them were clever enough to be able to start banks in Wales.

Sometimes the groups of cattle were brought along singly, and sometimes they went in masses. One hundred bullocks to a man with his pony and two dogs was the usual number. The speed varied with the pace of the slowest bullock. Where there was ample grazing, the herd might spread out over a wide area across the hills or along a good distance on either side of the road. But enclosures often caused the animals to keep in single file because the

path was now so narrow. A curious feature is that unless the track was previously a prehistoric route, it is rare for a drove road to be a parish boundary.

Where the drove roads offered the best route, or were the driest way of getting along after stones had been placed on their green surface, sometimes the whole route, or portions of it, were taken over by Official Road Surveyors; Ogilvy, Surveyor of Roads to Charles II, built part of his coach road in Shropshire near Bishop's Castle on a drove route. But drovers sought to avoid coach roads because their stoned surfaces—especially after Macadam—caused additional wear to the "cues" of the bullocks and so additional costs for shoeing.

The drover might vary his route if the old one was getting too congested and pasture or accommodation at the accepted farms, houses or inns was becoming inadequate. Hence the large number of inns, farms and resting places all along the tracks. A great place of convergence of drove routes was Evesham, where a night was spent prior to going over the Cotswolds.

The Restoration of 1660 ushered in a wave of prosperity and hence a greatly increased demand for beef. By 1701 all classes in most of southern, central and eastern England were eating beef several times a year. Even though the Scottish droving trade started to flourish about 1701, this did not harm the prosperity of the increased droving trade from Wales.

The last phase was when tolls were abolished and the cattle came along the main roads without shoes. This was the era 1890 to 1914, when farmers bought cattle at Rhyader (Radnor) to sell at Kington Fair. The journey took two days and the fee to the drover for 20-30 cattle was 4*s*. and unlimited cider. The last drover to have made this journey died in 1944.

BRUSH-KILLERS

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From trials with the hormone brush-killers, 2,4-D and 2,4,5-T, on his own farm, Dr. Smith points to a reasonably economic way of cleaning up the hedgerows.

MUCH is already known of the effect on various woody weeds of the herbicides—2,4-D and 2,4,5-T—usually sold under the name of "brush-killers". Much more has still to be discovered. The value of these herbicides, both singly and together, must therefore vary from farm to farm, according to which of the woody weeds is troublesome on particular types of land and in particular situations.

We already know some of the woody weeds which are likely to be affected: we already have some assessment of their degree of susceptibility. We know what is likely to happen when these weeds are sprayed with the herbicides at the usual spraying time—that is, when the weeds are in full leaf and active growth—and sprayed with water to which the prescribed quantities of herbicides have been added. Provided this knowledge is used with due regard to the conditions under which trials have been made, we are on safe ground. But we must bear in mind that there are other ways of applying herbicides which give very different results. For example, if the herbicide is applied to

the woody weeds in a fine spray of oil and during winter when the plants are dormant, much of the selectivity is lost. Practically all species may succumb to this treatment. Clearly the choice between summer spraying in water and winter spraying in oil must depend upon whether a selective treatment or a complete kill is desired.

Brambles and Thorns There are two groups of shrubby plants with woody stems that concern a majority of farmers. These are the brambles and the thorns. The brambles are invariably weeds. The thorns are an asset in the hedgerow, but are weeds in brush or scrub and in pasture. It follows that where both brambles and thorns are growing in a hedgerow, a selective kill of the brambles is required. Where brambles and thorns occur in brush and scrub, a complete kill of both is required.

Can these two objectives be attained by the use of herbicides such as 2,4-D and 2,4,5-T? It seems that they can. Whereas both are susceptible to winter spraying, brambles are susceptible to summer spraying and thorns are fairly resistant. Thus by choice of the season for spraying and the vehicle (water or oil) carrying the herbicide, selective or complete kill can be achieved at will.

A word of warning is necessary here. Susceptibility and resistance (to summer spraying) are relative terms. Brambles are not completely destroyed by an application of herbicide. They are checked to such an extent that only a feeble re-growth from the roots occurs. Thorns are not completely immune to an application of herbicide. The check they suffer is moderate, and they recover. Much depends upon the precise conditions at the time of spraying, upon the formulation of the herbicide and upon the strength at which it is applied. Much depends upon the state of growth of the woody weeds and upon the prevailing weather. There is considerable scope both for judgment and experience.

The popular term " bramble " includes blackberry and dewberry. Scientifically, the *Rubus* species is very variable; as many as forty-five sub-species have been distinguished. Indeed some authorities regard these sub-species as rather artificial. They consider them as grading imperceptibly one into another. Certainly from the practical farming point of view, there is little to choose between them! They are all spread by seeds carried by birds and, more insidiously, by their habit of rooting at the ends of the long canes. It is this latter habit that makes the brambles so damaging in the hedgerows. Not only do they spread into the neighbouring arable or grassland, but they also span the adjoining ditch. By rooting on the opposite bank, they hold up the passage of debris, cause silt to deposit, and in time fill up the ditch. Many pre-war overgrown hedgerows a chain or more wide, with the ditch completely filled, were the consequence of unchecked growth of brambles. Such thickets were often the safe harbourage of many rabbits.

Winter and Summer Spraying The control of brambles is without the least doubt a farm priority. Unfortunately, cutting is only a temporary measure; the brambles spring up again vigorously from the roots. Burning is also unsatisfactory; the dead canes blaze up, but the thicket is usually too " hollow " to sustain the fire. When the quantity of brambles justifies the cost, radical clearance is the remedy, and, when the land is accessible, modern brush-cutting and earth-moving machinery offer the best way of tackling the job.

The average farmer, however, is anxious to avoid heavy expenditure to keep his farm tidy. He wants to keep his hedgerows within bounds, to clean out the ditches, to destroy unsightly rubbish about his yards and

buildings. Most of this incurs costly manual work in places inaccessible to mowing machine or plough. Chemical control is therefore a useful alternative, which fits easily into the standard spraying programme. No less than 18,260 farmers possessed suitable sprayers at the end of 1954, and the number is increasing. Many spraying machines are available for hire. The additional equipment for spraying woody weeds is a length of pressure hose, say 60 feet, and a hand-lance or spray gun, or simply a length of metal pipe with a few nozzles connected to the pump in the place of the spray booms. When a sprayer has done its work in an arable or grassland crop, it can often conveniently go on to spray woody rubbish about the farm.

This includes the possibility of spraying brambles in the hedgerows, since the thorns are comparatively resistant. The term " thorn " in its usual farming meaning includes the valuable whitethorn (*Crataegus monogyna*) and the useful blackthorn (sloe, *Prunus spinosa*). The whitethorn is rather more resistant than the blackthorn. (Another thorn, the buckthorn, is, however, susceptible to summer spraying.)

Fortunately, the average hedgerow is not generally a uniform mixture of brambles and thorns. On the contrary, the brambles usually occur in thickets which monopolize some length of hedgerow, while the thorns dominate other lengths. Elsewhere brambles and thorns are in competition. It is rather difficult to know how far to go in spraying such hedgerows with herbicide, but by careful handling of the spray gun and using it in still weather, most of the herbicide can be put where it is wanted. If the spraying is not overdone, the brambles can be checked sufficiently to give the whitethorn an advantage in the competition for living room. The treatment must make gaps where formerly the brambles flourished. Later on these must be filled in with young thorns.

The indiscriminate kill resulting from winter spraying in oil is, by comparison with the need for care in summer spraying in water, a carefree and joyous enterprise! The work is done at a season when the sprayer is otherwise idle. It is done at a time when the farm staff are none too easily provided with outdoor work. This spraying can be carried on in almost any winter weather. In fact, the only worry is the cost of the oil. By the use of small nozzles (say 3/64 inch), the spray can be made to cover a lot of woody growth, since there is little leaf to absorb it. Moreover, the oil can carry the herbicides at a much greater concentration—indeed, up to thirty times greater than is usual for summer spraying.

Even so, oil costs more than water, and to meet the objection of expense, trials are already in hand of new formulations to apply herbicides in winter at less cost. Farmers may still think it worth while to spray thickets of brambles and other woody rubbish when growth is dormant. The dead wood can then be cut in due course with the knowledge that only limited growth from the roots can result.

Those farmers whose problem weed is not bramble, but some other woody species, may be interested to look through the following tentative lists:

Susceptibility of Woody Species to Brush-killers

Susceptible	*Moderately susceptible*	*Moderately resistant*	*Resistant*
Hazel	Silver birch	Whitethorn	Ivy
Elder	Sweet chestnut	Blackthorn	Holly
Broom	Mountain ash	Oak	Juniper
Willow	Gorse	Rhododendron	

This relates to *summer* spraying in water: as already stated, all these are susceptible to winter spraying in oil.

Here then, in the use of brush-killer, is an easy and promising extension of current spraying technique. It does not do away with cutting, clearing and burning altogether, but it greatly reduces the amount of such manual toil. For example, in one set of trials the cost to the Highway Authority of cutting a mile of verge was reduced from £15 to £7 by the use of spraying. There was a further useful saving because there was less rubbish to be carted away. No doubt similar economies could be made on many farms.

What of the risk of damage to neighbouring susceptible crops, such as roots, from drifting spray? As the time to spray brush is not critical, it is wise to keep the work for a calm day. Fine drifting spray is, in any case, not so suitable for treating brush as coarse spray, which settles.

AGRICULTURAL STATISTICS: ENGLAND AND WALES

GLASSHOUSES (January 1955)

	January 1954	January 1955
TOTAL AREA OF GLASSHOUSES	*acres*	*acres*
With heating apparatus	3,928	3,889
Without heating apparatus	708	720
TOTAL	**4,636**	**4,609**
CROPS IN GLASSHOUSES AT JANUARY 15		
Lettuce	520	505
French beans	3	3
Mushrooms	38	32
Other vegetables and herbs	62	65
Carnations	160	166
Roses	97	107
Orchids	10	10
All other flower and foliage crops	592	647
All other crops not specified above	422	348
Remaining glasshouse area (being the area unused at January 15, or used for other purposes not shown above)	2,732	2,726
TOTAL	**4,636**	**4,609**
CHRYSANTHEMUMS IN GLASSHOUSES		
Area of chrysanthemums grown in autumn and winter	794	771
LETTUCE IN GLASSHOUSES		
Area completely cleared before January 15	76	69
Area as at January 15	520	505
Area to be planted between January 16 and March 31	336	377

Notes 1. Holdings with less than 1,000 square feet of glass (including lights, etc.,) are excluded.
2. The term "glasshouses" includes Dutch light structures which were glazed at the census date.

MODERN TRENDS IN BRECONSHIRE FARMING

H. EDMUNDS, B.Sc.

County Agricultural Officer, Breconshire

With more than half the land in Breconshire at over 1,000 feet and the greater part of its farming area rough grazing, sheep and store cattle are the predominating enterprises, and each is complementary to the other.

BRECONSHIRE has an area of 466,347 acres, of which some 154,000 are classified as "crops and grass". The remaining area in farming occupation consists of enclosed and common rough grazings and is estimated to be about 230,000 acres. Roughly, then, we have 1½ acres of rough grazings for every acre of cultivated land. The following figures show that nearly all the county is at a high altitude:

Percentage of Land lying within given Contour Belts				
0-100 ft.	101-500 ft.	501-1,000 ft.	1,001-1,500 ft.	Over 1,500 ft.
Nil	6·2	36·5	39·3	18·0

The country and the weather are an indivisible whole. The weather helps to fashion the country and its life, and the country influences the weather. With such a proportion of high land, cool summers, cold winters and much rain are to be expected. Nowhere is there much trace of summer kindliness after early November. The mountain ranges are mainly in the south and west and cause heavy rainfall in their vicinity, but in the eastern valley bottoms the climate is much drier. Rainfall therefore varies widely—from 80 inches to 34 inches, depending upon situation.

Good and Bad Soils Forbidding as the climate appears to be, its influence on farming is ameliorated by the comparatively large expanse of Old Red Sandstone soil. It is the major soil formation, occupying what might be described as the central part of the county. It is a kindly and responsive medium loam, never very shallow. It is all well farmed and produces heavier crops and better stock than the poorer, less fertile soils at much lower elevations. There is virtually no limit to its cultivation if ploughed by crawler, harrowed by heavy discs and sweetened with lime and compound fertilizers. Much more could be done, but we need the ingenuity of a master lawyer to drain the legal bog of common land, before the engineer, the chemist and the plant breeder can begin to attack the last stronghold of bracken.

To the north of the Old Red Sandstone basin lies the Upper Silurian series. The soils are shallow, low in plant nutrients and indifferently drained. They are cold and slow starters in the spring. To the south is a thin strip of Carboniferous Limestone, of little direct agricultural significance. Its value lies underneath, in the lime and limestone which it provides ready to hand. Finally, we have another narrow area overlying the Coal Measures, which is the northern end of the South Wales coalfield. Coal and people go together, and consequently farmers in the southernmost fringe are milk producers. Agriculture, as in other similar areas, is but a humble and lowly partner of industry.

More so in the past than at present, the natural drainage of a region had a vital bearing on communications. Roads, canals and railways were more

easily constructed along rivers and streams than they were over hills and mountains. This in turn influenced people and the farming, as contact with the outside world was easier in some directions than others. Breconshire is slightly tilted towards the east, and its north, west and south boundaries are on the highest range of hills. Rivers therefore flow east or south-east towards the English border counties. With greater ease of travel in modern times, the mental horizon, previously conditioned by geography, has lifted, but Breconshire farmers still look eastwards rather than westwards. The exception to this general statement are some hill farmers, who for generations have looked upon the Cardiganshire coast as a suitable wintering ground for their ewe lambs.

Oats and Milk Except for the few larger and more sheltered lowland farms, the sale of grain does not amount to much. Even on these holdings the chief crop is oats, grown primarily for stock feed rather than cash. Seed potatoes are undoubtedly a most lucrative crop; but in spite of a mass of indisputable evidence, no progress is being made beyond maintaining the small nucleus of present growers. Crops are grown for stock, and if self-sufficiency is a policy of wisdom, then Breconshire farmers are veritable sages.

Unlike neighbouring counties where milk is the major product sold off the farm, producers in Breconshire are much more multiple-minded. The dairy cow is nearly always associated with the breeding ewe; some cows in the herd may produce milk for sale, while others suckle calves. In recent years these have been sired mainly by Hereford bulls. A.I. fits in well for producing the herd replacements.

The following table gives county milk production figures in recent years:

Year	Producers		Milk in		Total Milk
	Number	per cent	Winter	Summer	
			000 gal.		*000 gal.*
1951-52	661	27·5	1,921	2,325	4,246
1952-53	612	25·4	1,936	2,410	4,346
1953-54	592	24·7	2,054	2,431	4,485
1954-55	561	23·3	Not available		—

Thus, while the number of producers has been steadily falling, production has been increasing slightly. Those no longer in milk were mainly small farmers with two to five cows; the total loss in cow numbers was relatively slight and has been more than offset by the increasing efficiency of the remainder. Dairy herds in certain cases have slightly increased in cow numbers but, due to the combined use of cows for milk and for rearing, no satisfactory numerical separation between the two purposes can be made.

With beef store cattle and sheep prices as satisfactory as they are at present and likely to be in the immediate future, there is little prospect of any increase in milk production.

Sheep and Store Cattle Of infinitely greater importance over the county as a whole is the rearing of sheep and store cattle. Generally, the ratio of sheep to cattle is high, but it varies between hill, marginal and low lands quite substantially. Cattle are complementary to sheep. Although they are important as a direct source of income, no measure of net returns from cattle can be final without taking into account the effect on the pastures and on sheep profits. Indeed, on a large number of

our better hill farms, cattle are run primarily to keep land in order so that both short- and long-term returns from sheep can be maximized.

Sheep breeds, both national and local, are varied, and the whole sheep organization contrasts in its complexity with the simplicity of cattle. It will be convenient to deal, first, with sheep breeds in relation to their environment, and, secondly, with the management systems.

Due to a fairly wide variation in climate throughout the county, coupled with the degree of cultivation that is possible, sheep habitats are not uniform. Where ewes are run on high, exposed rough grazings for the full year, the small hardy Welsh Mountain has no equal. Evans* subdivides this breed into three types—Cardy, Glamorgan, and Talybont. Under slightly better hill conditions, we have the Welsh-Cheviot cross, concentrated in the Sennybridge area. Welsh ewes are the foundation of such flocks, bought in at regular intervals and crossed with hardy Cheviot rams. Again on hill farms, but where ewes can be brought into enclosed land for 3-4 months in winter, are the Speckle-faced Welsh and Radnors. In some cases, these are again based on regular infusion of Welsh ewe blood, but in others the types are now so well established that they rank as pure breeds. Indeed the Radnor breeders have recently opened a flock-book, and the breeders of the Speckle-faced Welsh are thinking of doing the same.

Marginal farms, with little or no rough grazings and a proportion of crop land, are able to support more productive ewes. While the ewe flocks are either S.F. Welsh, Welsh-Cheviot, Radnor or the improved Welsh, the rams are mainly Cluns, some Suffolks and, very recently, a few Border Leicesters. Care is needed in crossing to avoid what is locally known as too much "breediness". One cross is usually enough for this class of land. In other words, this is half-bred country, but the half-breds are almost all dark-faced. It would not be difficult to produce a counterpart of the Scottish Half-bred, but so far, there is little evidence that a change would be of financial benefit to our farmers. The fuel is here however; it would be easy to ignite it, if necessary.

Our lowland farms support many pure-bred Clun flocks or, more commonly, two to three top crosses of Clun blood. Suffolk rams are widely used, but more for fat lamb production than for the sale of breeding stock. Shropshires and Kerry rams were once popular and so were Ryelands. We may well see a revival in popularity of the latter as a crossing ram for the fat lamb trade.

Diversified Sheep Management Equally complex are the systems of management. The products sold are wool, meat from wethers and lambs, and ewes and store stock like draft ewes and store lambs. No attempt is made to assess the exact relative importance of each product in relation to the type of farms from which they come. The present marketing system of meat is fluid; it is too early to say whether present trends will settle down. Although store stock prices generally follow guaranteed meat prices, considerable fluctuations are possible from year to year. Wool prices, too, are now much higher than they were a few years ago. Consequently what might have been accurate ratios between one and the other, say ten years ago, for each sheep area, are now out of date.

Again, it is convenient to discuss the different forms of management under various types of sheep land. Firstly, we have those high altitude farms, composed almost entirely of rough grazings and with little enclosed or culti-

* An Ecological Survey of Hill Sheep Farming in Breconshire. W. Evans. *Agriculture*, 1951, **58**, 5-13.

vated land. These hills are grassy, mainly nardus, fescue and molinia; there is little heather. The ewes spend their entire year in this environment. The farms are large, the sheep active. At tupping time, rams have to cover considerable distances to serve the ewes, and fitness, in at least two senses, is therefore an essential quality. On average, each ram serves only about 30 ewes. Over a period of years, lamb crops are around 60-65 per cent; this season it will be nearer 45 per cent. In a hard environment, heavy culling of lambs and ewes of all ages is desirable. But with a relatively small crop from which to choose, and the need to maintain the flock strength, ewes that will breed are maintained for five, six or seven years. Older ewes are better breeders than young ones. Age is equally important with the other class of mature stock, namely wethers. Three- and four-year-old wethers are still fairly common, and this noble animal has no peer for meat production from wild places. Long may he live! With such a high proportion of mature ewes and wethers, wool is an important commodity. It is probably the most important, compared with the income from draft ewes and store lambs.

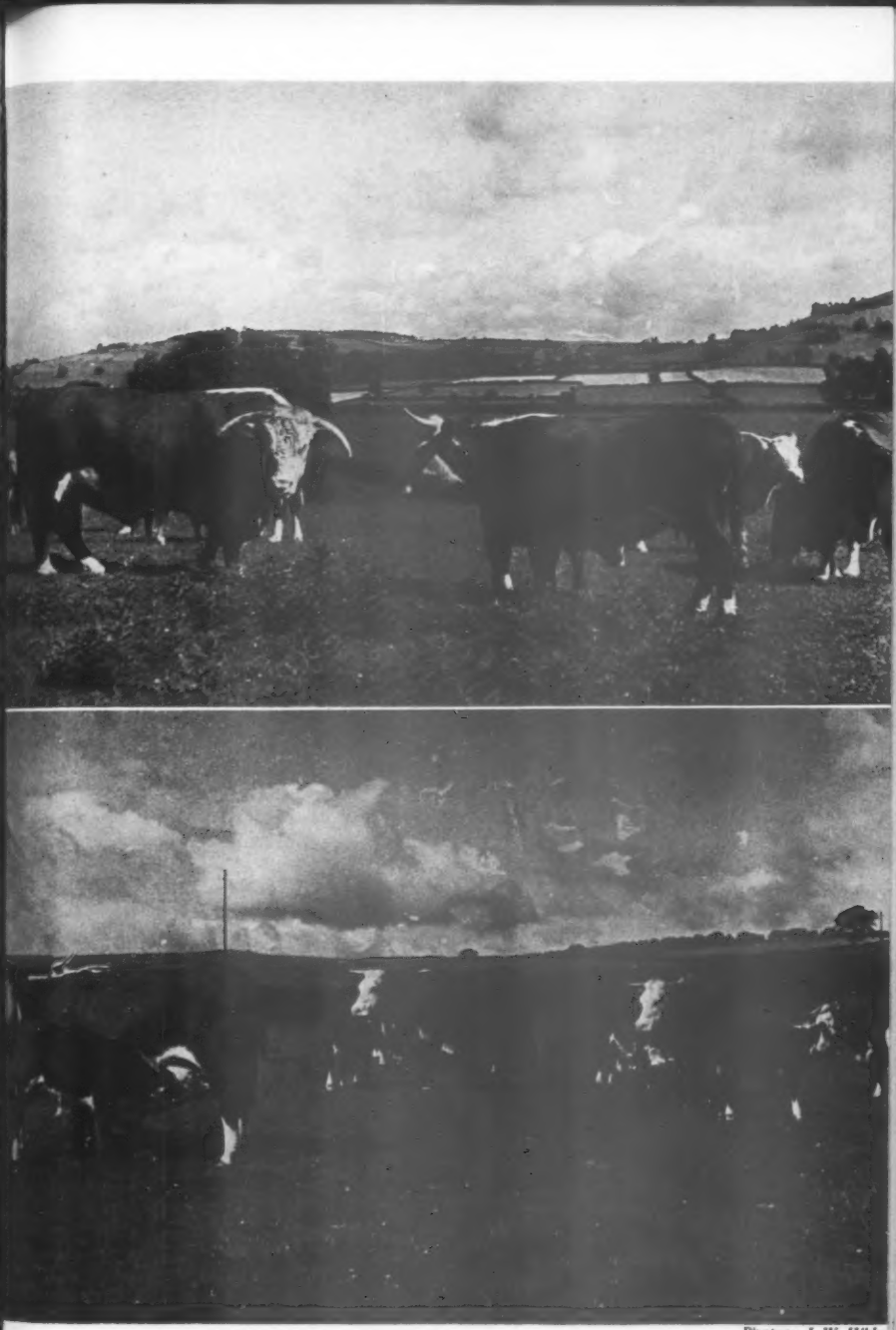
Tribute must be paid to the human stock on these hills. Shepherds are born rather than bred. The calling passes like a cloak from father to son, and with it the inherited knowledge and accumulated experience. These men love their sheep, they have the physique to withstand the rigours of the high hills and a nature that knows no burden from long hours of solitude and loneliness.

Then there are the hill farms with a good deal of rough grazing, but with some cultivated land. The sheep products are the same—wool, meat, draft ewes and store lambs—but their proportions differ. The ewe flocks are brought off the rough grazings for three to four months during late winter and early spring. With the improved conditions, lamb crops are in the region of 80-85 per 100 ewes. With more ewe lambs, draft ewes can be sold at an earlier age—commonly after three crops of lambs. Wether lambs are fattened off rape in October and November. Mature wethers are few, but frequently these can be fattened as yearlings or two-year-old sheep. Wether mutton is therefore relatively insignificant and so is the trade in store lambs. Draft ewes and fat lambs are the primary products, followed by wool.

Thirdly come the betwixt and between marginal lands, where hill and lowland systems merge. Ewe flocks are maintained throughout the year on fenced, cultivated ground. Nutritional standards are higher, the edge of climatic conditions less keen, and sheep more domesticated. With a Clun or Suffolk ram on one of the hill breeds, lamb crops range from 100 to 110 per cent. The best wether single lambs often are good enough to sell off the ewe in midseason, but rape again is the favoured fattening crop for the bulk of them. The cross-bred ewe lambs are frequently run for another year, and sold as yearlings.

Fourthly, are the lowland farms, where again a range of management aspects are practised. Ewes are heavier and more prolific, with lamb crops of 110-150 per cent. The major products may be fat lambs, from flocks of older ewes, or the emphasis may be on the sale of young breeding stock, with lambs for meat of less importance. Lambs may be fattened off grass, off rape or folded over swedes and sold as tegs in late winter. Flocks are mostly self-maintained, and it is common practice to put the best ewe lambs to the ram in their first autumn. Wool is a substantial earning product. From the many farm accounts which the N.A.A.S. have analysed, it ranges from 25 to 33 per cent of the gross sheep income. Gross income per ewe runs up to £13 per year.

Breconshire is a sheep world of its own. It is diversified in many ways. It has many breeds and crosses, its wool grades are numerous; sheep meat



Photos : *J. W. Hibler*

Brecon Beef

An attested herd of Herefords on the farm of Mr. Gilbert Evans, Brecon.

Welsh Mountain ewes of the Talybont type, with lambs from a Clun cross.

Photos: *Farmer and Stock-Breeder*

Speckle-faced Welsh ewes and lambs, which are popular on the better class of hill farms.

Shropshire Dairy Farm
(article on pp. 214-7)

Photo: *I.C.I.*

The Pentre Morgan self-contained herd of attested Friesians on a Cockle Park ley.

Photo : *C. O. Gill*

A typical heifer from the herd, showing good body conformation.

Photos : *F. D. Smith*

Brush-killers
(article on pp. 221-4)

Brambles and briars succumb to summer spraying with 2,4-D and 2,4,5-T. The lower picture shows (*right*) checked growth of bramble, leaving (*on the left*) whitethorn unaffected.

may be from early grass lambs, rape-fed lambs or tegs, or mutton from both wethers and ewes. Draft ewes are sold from the age of 1½ years to many years with lamb crops from 60 to 150 per 100 ewes. Draft ewes realize from £2 to £11 and lambs from £2 10*s*. to £8 each.

Cattle Management tightly Controlled While breeds of sheep and systems of management have to accord more to nature than to man's wishes, the same position does not apply to beef cattle. They are a product of cultivated land, fed on nominated crops which are a direct result of human effort. Also they are housed in the winter. Management is therefore tightly controlled. But there appears to be some unknown factor in breed which enables the Hereford cow to remain true to type when she lives on Red Sandstone soils. She originally developed on this formation, which has remained her nursery for at least 150 years. She seems to be much more a product of one soil type than any of the other great beef breeds. Over the years, then, this breed has remained remarkably popular and the store cattle trade is actually a trade in Hereford stores, to the exclusion of everything else. Ever since this specialization began, the major sale product of the breed has been the steer, sold at 12-18 months of age. Surplus heifers and barren cows are the minor income-earning products.

Heifers calve in the spring at three years old, and their breeding life runs to about seven crops of calves. By comparison with a good dairy cow, her Hereford sister has, very much, a life of ease and pleasure. She would work a little harder if her productive life started earlier and finished later. To achieve the former, means better feeding and management for the first two winters, so that she is as big at two years as she is now at three. To achieve the latter, is more difficult. The commonest cause of disposal, as a barren cow, is worn teeth, the reason for which is probably a mixture of nutrition and genetics.

On lowland farms, calving the cows begins in late February and early March, but at higher altitudes the corresponding time is April and May. Ideally, life from the cow and life from the soil should coincide. If the latter precedes the former, then too much grass produces too much milk for the young calf. Domesticated as Hereford cows are, they still have the primitive dislike of man milking. Each cow suckles one calf through the summer, which is weaned in late October or early November. At that time, steers are generally separated from the heifers.

Steers are given preferential treatment in their first winter, particularly if it is the practice to sell in the following spring at 12-15 months. Heifers are normally kept for two winters, and those surplus to herd requirements are marketed in their second spring. The tragedy is that many which are good breeding stock are slaughtered the same summer. Until very recently this system of management, based on one breed and on one primary product (steers), has been remarkably uniform throughout the county.

Calf Sales In 1951 a change started, for in that year the sale of calves directly off the cow began. Wintering is the eternal problem on hill farms; fodder is usually good enough for mature cows but is rarely varied or nutritious enough for growing beef stock. Why rear calves well through the summer and have them decline in the winter? Sales of suckled beef calves have been held in October for the past four years, and are now becoming an established feature of our cattle husbandry. The corresponding development is the keeping of more breeding cows.

This break from the long-established trade in 12-18 months stores may well be much more decisive than we realize, and it is worth recording, if only from an historical angle, the birthplace of the change. At a meeting of the Breconshire A.E.C. Livestock Sub-Committee, held on July 12, 1949, the relevant extract from the Minutes reads:

> The County Agricultural Officer further stated that many of the farmers now rearing calves, particularly those on upland areas, were not in a position to feed adequately the weaned calves in their first winter. It was *resolved* that the National Farmers' Union be asked to discuss this matter and if necessary to request the auctioneers in the county to advertise that special sales of weaned calves be held in the autumn..

The seed fell on fertile but lumpy soil; much harrowing and some rolling by the N.F.U. was necessary before germination occurred.

Reference to cattle in such a county as this would not be complete if the fashionable "stores from the hills" theory were ignored. At present, our hills are mostly open, unfenced, common grazings, rich in sheep and rich in commoners who dislike collective action. Improvements to these hill grazings on any scale is but a dream. There is a good deal of evidence, however, that some Welsh Blacks could be acclimatized successfully, but the limitation of supply of suitable breeding stock is one great difficulty. The other is the need to grow or buy additional hay or other fodder.

GOOD ESTATE MANAGEMENT

THE BUCKHURST ESTATE

E. T. KING, M.B.E., M.M., T.D., F.L.A.S., and
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Lord De La Warr's full appreciation of the value of grass, linked with sound husbandry and good management, furnishes an outstanding illustration of what can be done without the help of outside capital.

THE Buckhurst Estate of about 2,500 acres adjoins Ashdown Forest in East Sussex. When Lord De La Warr took it over in 1921, the estate covered 4,000 acres. Nine farms were let to tenants, 1,000 acres were in woodland and about the same area in parkland, much of which had once been farmed but had reverted to bracken and scrub. He was determined from the outset to turn the estate into a sound agricultural proposition, but he was not willing, nor indeed was he able, to pour capital into it. This necessity to be commercial forms the main interest of the story of the Buckhurst Estate over the last thirty years.

The soil is mostly Ashdown Sand and all about 300 feet above sea level. The estate now includes 700 acres of tenanted farms, 850 acres of woodland and a Home farm of 814 acres. The park and scrub have been reclaimed and incorporated into the Home Farm or added to one or other of the tenanted farms to round off boundaries and improve access.

It is truly amazing that the modernization and repairs of the farm buildings, the roads and services, the removal of over three miles of hedges, the draining, the erection of several new cowsheds and Dutch barns, and the

installation of the drier and grain storage plant alone, to say nothing of the work and expenditure involved in building up the fertility of the Home Farm, have all been carried out without the aid of outside capital. If good estate management implies cutting the coat to suit the cloth, then here is a convincing example of how successful such tailoring can be.

It all began with Earl De La Warr's belief, shared with Sir George Stapledon, in the future of grass as a crop. He was convinced, as his two Managers (first Mr. Pusey and now Mr. A. S. Christensen) have since been, that even Ashdown Sand, properly managed, can produce bumper crops and support heavy stocking. Reclamation of useless scrub and worn out parkland therefore began the story, with heavy applications of chalk, top dressings of carbonate of lime and pioneer crops of rape and kale and Italian ryegrass and clover. The result of this policy has been a steady increase in production on the Home Farm, necessitating additional and improved buildings to accommodate it. From this example, farms both on the estate and elsewhere in the neighbourhood began to improve their method of farming, and so increased their production. The Home Farm of the Buckhurst Estate, far from being a small model farm run at a loss, is a relatively large one serving as a model for others sometimes on better land, and producing a very gratifying income on its own account.

The Home Farm The largest unit on the estate, both in area and production, is the Home Farm. In 1945, when Mr. Christensen took over the management, the annual production was £17 10*s.* per acre. The farmed area was then almost 1,000 acres, but included some outlying land near Groombridge and Crowborough, which entailed uneconomic transport costs. Some of this was therefore let off or added to existing farms. By 1947 the grass drier had been installed and there had, of course, been an increase in agricultural commodity prices. But already, and in spite of the 30 per cent drop in the Home Farm acreage, the farm production had been developed to almost £50 per acre.

The Home Farm is not well placed, and the homestead itself is very much off centre. It now lies entirely within a ring road but is intersected by five streams which complicate farm operations by long hauls. The number of fields have been reduced, by the removal of over three miles of hedges and the piping of their ditches, from 78 to 38 and, by reclaiming awkward corners, better shaped fields have been obtained. These changes brought the Home Farm to its present total of 814 acres. Apart from the maintenance and woodland staff, twenty-three workers are employed, and a few brief particulars of the farming will explain the need for this number. Most are housed in the fourteen cottages on the farm. In 1954, 226 head of cattle, 770 sheep, 496 pigs and 1,670 poultry were maintained on the Home Farm. Wheat accounted for 96 acres, barley 105 acres, oats 61 acres, roots 6 acres and potatoes 16 acres. Apart from the 29 acres of rough grazing, there is no permanent grass.

Ample summer grass and the limited stock-carrying capacity of the land in the winter, due to poaching, has made grass a cash crop. As a result, the drier at Buckhurst was installed in 1946 and was the first one in the county, as incidentally was the ventilated-bin type of grain storage plant. The grass drying and cubing plant is now in its ninth season and has handled 2,000 tons of dried grass, giving a turnover of ten times the initial cost of the plant. It is housed in a double-span precast concrete building and adjoins the grain drying and storage plant, so that its three built-in pens can be used for harvested cereal and dressed seed corn as well as grass cubes.

The grain drying and storage plant, with a capacity of 300 tons, was constructed about five years ago, at the remarkably low cost of £1,836. The grain is conveyed from the reception pit pneumatically; it is not handled until it is bagged off after milling or sacked for disposal and wheeled on a level floor through the old granary to a lorry-level platform. The roof over the five silos and the cleaner is provided by a framework of larch poles and a mixture of home-grown and foreign timber. A contractor supplied and fixed the roof sheeting at a cost of £110. The foamed slag floors are taken up each year for cleaning, but as this operation causes some wastage in the handling, it has now been decided to provide a pierced steel sheet floor to one silo a year at a cost of £40 each, thus saving future maintenance costs.

The double range cowshed on the Home Farm has eighty standings and is also of a precast concrete framework over a 33 feet span. There are covered approaches for feedingstuffs and milk, and the silage stacks (one containing about 300 tons) are no more than 40 yards away. The old cowsheds have been converted into an enclosed tractor shed and fertilizer store. About 150 tons of fertilizer are used every year, which works out at about £4 per acre. Lord De La Warr regards fertilizers at this rate as the cheapest form of feedingstuffs.

The 75 followers are housed throughout the winter in two-bay open shelters each 30 feet wide. They are of timber and steel and back on to a five-bay Dutch barn, so that feeding presents no problem. Bulk storage is in a nine-bay, pre-war steel-framed Dutch barn supplemented by a lean-to made of telegraph poles and corrugated iron.

There are four pig houses about thirty years old constructed of timber studding on concrete plinths about 2 feet high. The exterior is of weather-board or corrugated iron, the interior of match-board. The old pen divisions of heavy gauge corrugated iron have recently been replaced by concrete block partitions. Ceilings at eaves level made of galvanized wire netting covered with open sacks and six inches of straw, are considered desirable despite the lack of ventilation. The problem of providing suitable roads to reach troughs dispersed over a steep exercise ground has been overcome by a continuous trough, known as "the running buffet", on the edge of a two-acre pasture and wood. There is a hard approach to the trough from the food store. The cost of this modest capital equipment to house pigs with a turn-over of £12,000 per year could not surely be any less.

The Home Farm poultry unit consists of prefabricated concrete slab and Nissen type huts, a cottage and a bungalow, and an old Sussex barn. The latter, which is 65 feet × 22 feet × 18 feet, has been adapted to accommodate a seven-tier battery in two ranges with a capacity of a thousand birds by the removal of the tie beams and the addition of 6 × 4 inch oak struts to the external walls. About half the area of each pair of barn doors has been glazed and six pairs of windows have been put in each side. The feather-edged boarding has been lined between the studs with sisal paper and a ceiling has been formed at eaves level, as in the piggeries.

Tenanted Farms The nine tenanted farms vary from 37 to 178 acres, with an average of about 70 acres. Milk is the main item. The success of the Home Farm's four-year leys has had a great effect upon the smaller farms nearby. On most of them the leys amount to more than one-third of the area and on some of them the stocking reaches the remarkable figure of one cow equivalent to two acres. A famous Jersey herd has the great achievement in this neighbourhood of producing an average of 6,100 lb. of milk for each of ten heifers and 9,000 lb. for each of 12 cows on a holding of 90 acres.

Most of the holdings went over to milk production in self-defence in the 1920s. To comply with the regulations of those days, cattle shelters were boarded on the open side and concrete floors laid. About two-thirds of the cows on the tenanted farms are, however, now housed in new cowsheds and the old milking premises have been converted to accommodate followers. In some cases the centre of the yard serving these buildings is well-packed hardcore surrounded by a concrete causeway, and the cleanliness of every farm, due to rather more concrete than usual, is most impressive. Hardcore costs 16-18*s*. a cubic yard delivered in this district and generally requires a coat of clinker or something similar to provide a surface and to prevent damage from frost. The concrete paving around the buildings, therefore, not only gives a clean access but has greatly reduced the maintenance costs both of the yard surfaces themselves and of the tools and farm machinery. Ten years after the war there is very little new equipment unprovided or older buildings that have not been overhauled. There is certainly no scope for the application of the Model Tenancy Agreement " obsolescence " clause on this estate.

Lord De La Warr decided that he would provide necessary improved equipment on any of the farms subject to a reasonable rate of interest being paid on the cost. It is of considerable interest that he undertakes all but minor repairs, a policy which gives the tenants the benefit of the maintenance staff and ensures uniformity of treatment throughout the whole estate. Despite this unusual responsibility for repairs, there has been no general post-war re-assessment of rents. It is a considerable achievement in estate management to have modernized practically the whole of the fixed equipment, costing three times as much as before the war, and at the same time to have provided a reasonable return on the landlord's expenditure.

The Woodlands Of the present 850 acres, 600 have been dedicated under the Forestry Commission Scheme. Most of the excellent beeches have passed maturity and are deteriorating rapidly. They are being sold by tender to be felled by the purchaser, but replanting is proceeding at the rate of 25-30 acres a year. A small nursery is maintained for replanting mixed conifers and beech. The woodland staff numbers six and they maintain all woodland fences, including rabbit fencing of a type which allows full use to be made of thinning.

Maintenance Staff Having regard to the amount of work carried out on the estate, it is surprising that the maintenance staff, including that for Earl De La Warr's house, numbers no more than four men—a bricklayer and his mate, a carpenter and a painter. For the last twelve months, however, an additional plumber and his mate have been temporarily employed installing over thirty modern domestic cookers and water heaters, etc., in the farmhouses and cottages on the estate.

Farm labour is employed on all tasks, except those calling for special building skill; the maintenance staff are not used, for instance, to replace the rotted foot of a Dutch barn, but, helped by a half-yard concrete mixer, Home Farm labour is well able to deal with the work of pouring a concrete pier. New cowsheds and the like have been built by contract, but most of the conversions and all the repairs have been done by direct labour, supervised from the Estate Office by Mr. F. S. Spendlove.

The grass cutting and drying staff is a seasonable labour force of seven, of which one is casual. During the off-season period, one is largely engaged in the maintenance and painting of the plant and the remainder transferred to fencing and reclamation work. This work is now largely completed, so at least two of the grass cutting staff spend the winter preparing the land for and planting trees.

Building Works Most of the new buildings consist of pre-cast concrete framework, with corrugated asbestos roofs. All new cowsheds are double range and generally have feeding passages. Usually infilling is of 4½ inch brickwork plus piers, lighted by galvanized steel wall windows. The faced brickwork gives a pleasant effect, and the complete rendering of the interior provides an easily washed surface. The valley gutter, that harbinger of high maintenance costs, has been carefully avoided wherever possible in rebuilding or converting, but the lovely old clay roofing tiles have not generally been replaced. Patching of roofs is not well thought of, because whenever a building needs repairs it is the custom to overhaul the roof as a matter of course. Thus, except for gale damage, the roof is likely to survive without further attention for many years. The usual width of new Dutch barns is 33 feet, which has been found to give the greatest proportion of dry storage in relation to accessibility and cost. Several are sheeted down on three sides.

In this part of East Sussex, timber-framed buildings on brick plinths and clad with weatherboards is the normal construction. Almost all such buildings remaining on the estate have now been "soled and heeled"; that is, the timber frame studs have been cut off at the lowest point of soundness, and brick or concrete block plinths built underneath. This not only makes the old structure completely stable, but also deals permanently with the manure problem.

A common difficulty on many estates and farms is the maintenance of large barn doors, particularly where they are on exposed or windy sites. The Buckhurst Estate uses steel framed barn doors constructed of 2 inches × 2 inches × ⅜ inch angle-iron, suitably cross-braced and covered with galvanized corrugated iron, the lower pair 7 feet and the upper pair 6 feet. These have been highly successful; even after seven or eight years they can still be latched with one finger, which speaks well both for the design and for the craftsmanship.

Fencing for sheep has been the rule for over twenty years. Light split chestnut spiles are hot dipped and driven in 2 yards apart, with the top row of barbed wire and the other five of 8-gauge plain wire. A typical fence (actually immediately opposite the Estate Office and enclosing a ley which is the winter exercise ground for young stock whenever that is possible), was erected hurriedly of green chestnut spiles in June 1930. It is likely to have a further ten years of life yet.

Services and Roads For a long time main water has been generally available and mains electricity is now laid on to almost every cottage and farm. Great foresight was shown when the main cable was laid to a transformer at the hub of the Home Farm to replace the private generator, because there are now as many as twenty electric motors, including one of 50 h.p., to drive the grass drier, and no overloading is likely. Until recently the original overhead lines and wiring of the private plant have been adequate to meet the needs of the improved dwellings, but with the extra load of increased domestic electrical apparatus, the South Eastern Electricity Board are now overhauling the wiring and metering each dwelling separately.

The heavy damage caused to farm roads by timber haulage is well known, but the Buckhurst Estate roads are standing up well to it, since they are kept in waterproof condition and generally tar-sprayed and shingled before the surface becomes badly broken. This work is usually done by contract, but some very successful access roads have been made on the Home Farm with hardcore and clinker. The first operation has always been very properly to

provide a good ditch on the uphill side and then to keep the road above ground level with a good camber to shed the water.

It is sometimes good policy to deny new capital to an existing undertaking. In the case of the Buckhurst Estate the decision to do so, and therefore to force it to be self-supporting, was not only bold but an accurate assessment of the potentialities of the estate as a whole.

Earl De La Warr's estate thirty years ago had 25 per cent of its land all but derelict and only 150 acres under corn. The pastures were weedy and undergrazed, bracken and gorse proclaimed the lack of lime, fences were in poor order, essential services were almost non-existent and production was low. Now there is a flourishing Home Farm setting the pace for the others on the estate and beyond it, with a famous pedigree Jersey milking herd and followers, 50 beef-type Shorthorns, 250 breeding Clun ewes, 500 Welsh Saddlebacks and a poultry unit for 1,500 layers. There is a 500 ton silage programme and an annual output of between 150 and 300 tons of dried grass cubes. The nine tenanted farms have, on average, almost one milking cow to every two acres, and all with modern equipment to meet present-day requirements. The cottages, nearly all with full services, are up to modern standards of fitness.

This transformation, which began with Earl De La Warr's decision to make grass pay, must be gratifying to all concerned. It could not have been achieved even with the firm belief in the value of grass and ley farming, without a sound knowledge of husbandry and management, much ingenuity and hard work, careful expenditure and accurate costing and, by no means least, loyalty to the estate and to its owner—in short, without good estate management.

We offer our thanks to Earl De La Warr for making available the material for this article, and to Mr. A. S. Christensen, his manager.

POTASH FERTILIZERS

G. A. Cowie, M.A., D.Sc., Ph.D., F.R.I.C.

Some of the questions which farmers are always asking about potash fertilizers are answered by Dr. Cowie.

THE importance of potash, or more correctly potassium, for crop production lies in the fact that potassium is one of the major nutrients essential to plants. Potassium fertilizers are generally known as " potash fertilizers " because in the fertilizer world they became associated with the potassium oxide compound called potash (K_2O), which is the conventional unit used in the Fertilisers and Feeding Stuffs Act for stating the amount of potassium in fertilizers. The four principal potash fertilizers on the British market are muriate of potash (60% K_2O), muriate of potash (50% K_2O), potash salt (40% K_2O), and sulphate of potash (48% K_2O). The lower-grade salt, kainit, is still used, but to a relatively small extent.

A question which farmers often ask is: if muriate of potash contains 60 per cent potash (K_2O) and sulphate of potash contains 48 per cent potash (K_2O), what is the other material that contributes to the 100 per cent? The explanation is that potassium, the essential nutrient, must have a carrier, which is chlorine in muriate of potash and potash salt (40% K_2O) and sulphate (sulphur-oxygen combination) in sulphate of potash. The potassium is combined with chlorine or with sulphate to form a neutral salt. Thus chlorine in muriate of potash is present as a chloride and has not the same toxic properties as the chlorine element itself.

A characteristic trend in the use of potash fertilizers in recent years has been the increasing preference for the most concentrated type of salt—muriate of potash (60% K_2O). Before the war muriate of potash (50% K_2O), which was then the highest grade of muriate available, accounted for only 35 per cent of the total potash used. At present muriate of potash (60% K_2O) constitutes the source of nearly 80 per cent of the total potash used. The saving in freight and handling is obviously an important factor in the dominant use of the potash fertilizer with the highest potash content. Another reason is that the highest grade muriate of potash is necessary for the manufacture of the modern and more concentrated types of compound fertilizers, which may contain up to 15 per cent or even 20 per cent potash (K_2O).

The Question of Purity An idea which has gained some currency is that by the use of the purer types of potash as well as of other fertilizers, something of value may be lost to the soil by withholding the so-called impurities that are present to a greater or less extent in the less pure fertilizers. Muriate of potash containing 60 per cent potash (K_2O) is equivalent to a content of approximately 95 per cent chloride or muriate of potash, while potash salt containing 40 per cent potash (K_2O) contains approximately 63 per cent of chloride or muriate of potash.

The main impurities in potash salt (40% K_2O) are rock or common salt (sodium chloride) and magnesium salts, but the relative quantities are not constant and may vary between 16 and 33 per cent in the case of rock salt, and from 0 to 10 per cent in the case of magnesium compounds, depending on the crude potash salts from which the fertilizer is derived. In kainit, the total quantity of the same impurities is still higher according to the lower content of potash (K_2O), but again the composition of the impurities is not defined for the above reason.

POTASH FERTILIZERS

Rock or common salt (sodium chloride) has a recognized value for sugar beet, fodder beet and mangolds, while magnesium salts are sometimes required, chiefly for horticultural crops like apples, gooseberries, glasshouse tomatoes and brassicas, etc. As possible sources of rock salt or of magnesium, the low-grade potash fertilizers are indicated, and it has been frequently suggested that the decreased use of these fertilizers may account for the more frequent occurrence today of magnesium deficiency. There is really no valid basis for this suggestion, because by far the largest proportion of low-grade potash fertilizers used in this country in the past, from the 30 per cent potash salt downwards, contained rock salt as the chief impurity and practically no magnesium.

Low-grade or High? In deciding whether it is profitable to use a low-grade potassic fertilizer for the crops in question, assuming that the impurities are known, the cost of the fertilizer delivered on the farm should be compared with the cost of the lesser bulk required of the high-grade potash fertilizer to provide an equivalent weight of potash (K_2O). It is possible to buy the impurities too dearly, and it may be cheaper to use the highest-grade muriate of potash (60% K_2O) and to supplement it by special dressings, as required, of rock salt or of magnesium—say, in the form of dolomite limestone (magnesium limestone) for acid soils or of Kieserite or Epsom salts for other soils. These sources of magnesium as well as salt are obtainable in this country.

So far as magnesium is concerned, there is another potash fertilizer not normally used in this country, called sulphate of potash-magnesia or "Patent-Kali". It contains approximately 26-30 per cent of potash (K_2O) in the form of sulphate of potash and 25-35 per cent sulphate of magnesia. The unit of potash in this fertilizer is dearer than in the normal potash fertilizers and, again, it is a question whether it is cheaper to buy the high-grade muriate of potash and the sulphate of magnesia separately. The question may be different with soft fruits, for example, which are more safely treated with sulphate of potash than with the muriate.

It has also been argued that by the use of the concentrated types of potash fertilizer certain trace or minor elements may be lost to the soil. Analyses have shown, however, that such trace elements as boron, manganese, copper, zinc and molybdenum, even in the lower-grade potash fertilizers, are present only in negligible amounts—from less than 1 part per million to no more than 5 parts per million. These quantities of trace elements are practically valueless in view of the relatively small dressings used per acre of the potash fertilizers.

Muriate or Sulphate? Another question frequently asked is what is the difference in effect between muriate of potash and sulphate of potash? So far as agricultural crops are concerned, no practical discrimination can be made between these fertilizers. In the case of potatoes, sulphate of potash yields a potato containing more starch and less water than one grown with muriate of potash. The level of starch content may be 1½ to 2 per cent higher from sulphate of potash, as compared with muriate of potash, using the normal dressings of potash for potatoes. This difference is obviously important where potatoes are grown for farina or alcohol, but it has little significance where potatoes are grown for direct edible purposes and no monetary credit is given for higher nutritive values. There is also some evidence that where high dressings of potash are used, such as in intensive market gardening and for very high-yielding potato crops, the potash might be more safely given either as sulphate or as a mixture of sulphate and

muriate. Similar preference should be given to sulphate of potash for tomato crops when grown intensively under glass.

Leaching A point about which many farmers are doubtful is whether potash is liable to be leached from the soil by rain. The potash in the conventional potash fertilizers is soluble in water, but when applied to the soil it is immediately absorbed in to the colloidal particles of the soil, when it is no longer water-soluble. From this particular combination, however, potash is liberated slowly by the so-called process of base-exchange and becomes gradually available to the crop as required. In ordinary soils the loss of potash by leaching is small and does not exceed more than a few pounds per acre per year. Normally, therefore, the application of potash in autumn to grass and winter crops is quite safe. In very sandy soils and in shallow chalk or granitic soils, however, it is advisable to shorten the period between the application of potash to grass and the advent of active spring growth, especially under high rainfall conditions.

Colour Another point worthy of note is that the colour of potash fertilizers should not be taken as an index to their potassium content. Minute quantities of iron oxide, clay or organic matter, such as may be present in the insoluble matter, tend to give a yellowish or brownish colour to the finished products. It is also interesting that, while high-grade muriate of potash made by the ordinary solubility method has a more or less white appearance, the corresponding product made by the flotation process retains the reddish colour of the original sylvinite.

WASHED OR UNWASHED EGGS?

Area Egg Officers in Britain and officers of the Egg Marketing Division of the Government of Northern Ireland met in conference with scientists and technologists at Harrogate on June 27. The following is a brief comment on one of the eight papers which provoked a good deal of interest and discussion.

NOT less than a third of the year's production of eggs comes on the market during three months of the year. Although prices normally fall during this time, the consumer does not vary his consumption of eggs in proportion to the increased supplies. The marketing problem, therefore, is to find a means, either natural or artificial, of levelling supplies throughout the year. The ideal, not yet achieved, is to maintain a constant yield; the alternative is to preserve and cold store the surplus from the "flush" to the period of scarcity.

Successful efforts to level supplies by preservation and cold storage depend on conserving the quality of the egg from the moment it is laid. From that moment, biological and chemical reactions start a process of deterioration. If these are stimulated by mishandling the egg after production, the chances of preserving quality during storage are diminished substantially. Long experience shows that, without doubt, quality control and successful preservation are inhibited more by washing than any other single treatment.

WASHED OR UNWASHED EGGS

As far back as 1919, it was known that washing eggs promoted a type of rot, chiefly green rot caused by *Pseudomonas* bacteria, almost impossible to detect by candling after cold storage. More recently, Australia found that washed eggs had to be excluded from her export trade if the trade itself was to survive.

The results of a survey published in this Journal ([1]) showed that about 30 per cent of eggs produced in the United Kingdom were washed. Other observations ([2]) suggest that the proportion of total rots in clean, unwashed, cold-stored eggs is 0.6 per cent, but that the proportion for "clean" eggs delivered to packing stations is 4 per cent. On the average, it seems, therefore, that about 11 per cent of washed eggs may rot during cold storage in this country. The figure may be higher and, until producers are prepared to co-operate fully, the size of the problem suggests only one remedy—a commercially practicable method of detecting washed eggs.

At Harrogate, DR. J. BROOKS, of the Department of Scientific and Industrial Research, described several chemical and electrical methods of detecting washed eggs which have met with varying degrees of success ([3]). Unfortunately, the effective tests are not quick enough to make practicable the testing of even a small proportion of the eggs graded each day in an average-sized packing station.

As a result of further work by Dr. Brooks and his colleagues, however, a practicable test seems to have been evolved which will identify correctly 97 per cent of washed or unwashed eggs. The test is simple and was demonstrated to the conference at Harrogate. Drops of a solution of chloride-free gelatin and silver nitrate are placed on the egg shell and exposed to ultra-violet light for 1-1½ minutes. Drops on unwashed shells darken and, after 1 minute's exposure, contain a dark red precipitate. Those on shells which have been, for example, rubbed with wet cotton wool or soaked in water for an hour or more do not darken and little or no precipitate appears. There were variations of the intensity of reaction at different points on the same shell and at the same point on different shells, but, as between washed and unwashed shells, there was little, if any, overlap. The lamp used was a 125-W mercury discharge unit enclosed in a bulb of woods glass, and the tests were made at room temperatures between 59° and 68°F.*

There are no regulations in Britain prohibiting egg washing or, as in Australia, compelling producers to deliver washed eggs in separate, labelled containers, but the problem of washed eggs in relation to cold storage is one which obviously we have got to tackle. Perhaps the solution may be found in the extensive use of a modified version of the test described, connoting further collaboration between science, marketing experts and the trade.

E. ST. J. HEIGHT.

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3. Detection of Washed Eggs. J. BROOKS and H. P. HALE. *J. Sci. Fd. Agric.*, 1955, **6**, 37-47.

* A full description of this test appears in the July 1955 issue of the *Journal of Science, Food and Agriculture*, pp. 368-73.

FARMING AFFAIRS

Japanese Beetle In 1916, Japanese beetles were brought into the U.S.A. with nursery stock from Japan. The result is that it is now a serious pest over about 50,000 sq. miles of that country, as well as in parts of southern Canada. One Japanese beetle was recently found in a military aircraft at Prestwick, and we are anxious therefore that the U.S.A. story should not be repeated in Britain.

In the U.S.A. both adults and larvae have a wide host range, comprising at least 250 different deciduous trees, shrubs and herbaceous plants. The adults feed on leaves (often until they are skeletonized), flower-heads and fruit, and the larvae on the roots. Among the many plants which they favour are strawberry, raspberry, apple, cherry, plum, peach, clover, rose, dahlia, elm and horse chestnut. The adult beetles choose ripe or nearly ripe fruit and the direct loss caused is liable to be increased by the secondary fungus attacks which may develop on damaged areas. Of farm crops, maize is the most seriously damaged in the U.S.A. The natural habitat of the larvae is permanent and ornamental grass, although they too attack a wide range of plants.

The beetle, both in its larval and adult forms, is not unlike our Garden Chafer. The adult is about half an inch long and bluntly oval-shaped. The head, thorax and rather thickish legs are a shining metallic green and the wing cases, which cover most of the body, a dull coppery brown. The body is green with a row of twelve white patches along the sides and at the hind end. This characteristic provides the most obvious distinction between the Japanese beetle and the Garden Chafer. The larvae is about 1 inch long when fully grown, and has a brown head and legs and a thick, whitish body. The smooth, hind part is bent under in the typical doubled-up attitude of Chafer grubs.

The adult beetles which emerge from pupation in the soil in July and August, are active in sunny weather, laying their eggs a few inches below soil level.

The Ministry has a descriptive leaflet in preparation, and any suspected beetles (look for the white markings along the body) should be sent in a strong box to the Plant Pathology Laboratory, Milton Road, Harpenden, Herts. Any found in Scotland should be sent to the Department of Agriculture for Scotland, St. Andrew's House, Edinburgh, 1.

Farm and Forest: 5. Raising Poplars Having decided that poplars can be cultivated on his farm, the intending grower will have to consider whether to buy his plants direct from the trade, or whether to raise them in his own nursery. If the former, the stock should be bought from a reputable nurseryman who is raising plants from material imported from Holland or Belgium or from cuttings obtained from the Forestry Commission. The varieties chosen should then be true to name and resistant to bacterial canker—the most serious disease affecting poplar.

If the farmer chooses to raise his own plants, a suitable nursery site should be selected; part of a well-manured kitchen garden will suffice, although there is no reason why the corner of a cultivated field should not be used, provided it is sufficiently fertile. The soil should be deep and moist, and easy to cultivate in all weathers. Soils which are predominantly clayey or sandy should be avoided.

The common commercial varieties of poplar are propagated vegetatively from 9-inch shoot cuttings, which are fully inserted in the soil during the winter. The plant at the end of the first season, when it is known as a one-year rooted cutting, will probably not have grown sufficiently strongly to be planted out. A much sturdier, better branched plant will be produced by transplanting the rooted cutting at a wider spacing in a different part of the nursery. At this stage the current shoot is cut off about an inch above the original cutting and the plant left to grow for another twelve months. After a year in the transplant lines, the plant (known as a one-year rooted cutting stumped and transplanted for one year) can usually be transferred to the field.

To ensure that the plants are established with the least delay, pits about 2 feet square and 18 inches deep should be dug for the reception of the roots. Before the beginning of the growing season, a mulch should be laid around each tree to suppress weed growth, and should be retained for four seasons. The mulch, which should be about 6 inches deep and 4 feet across, may be of grass, straw, bracken, or even sawdust.

Protection against vermin may be necessary and, depending on the number of trees and the size and shape of area planted, individual sleeves of netting or roofing felt, or a perimeter fence, will have to be erected if there is a risk of damage by rabbits. Should there be a lot of voles in the area, the lower part of the stems should be coated with a repellent paint.

Trees should not be pruned until at least the third season, when the lower third of the stem may be cleaned of branches. Subsequent pruning should take place every second year, always keeping a depth of crown at least two-thirds the height of the tree. In the early stages, if forking or die-back occur, selection of a suitable leader can usually be secured by removing the competing shoots.

Provided the trees receive proper attention, especially early in the rotation, and are adequately pruned, they should be readily saleable in twenty-five or thirty years time. Only if an unsuitable site has been planted, or if the wrong varieties have been used, will there be difficulty in growing the trees to usable sizes. In any event, only the best nursery stock should be planted out.

Full information on poplars, their identification, propagation, cultivation, rate of growth, and diseases will be found in Forestry Commission Bulletin No. 19 *Poplars*, and Leaflet No. 27 *Poplar Planting*, summarizes all aspects of raising poplars. These publications are obtained from H.M. Stationery Office, or through any bookseller, price 7*s*. 6*d*. (7*s*. 9*d*. by post) and 9*d*. (10½*d*. by post) respectively.

John Jobling,
Forestry Commission Research Station

The Mechanic on the Farm: 16. Preparing for Grain Drying

Some of the attention needed to ensure that the machinery for grain drying and handling is in good order can be given well before harvesting begins, but a number of adjustments can be made only when the grain starts to pass through the installation. First of all, each moving part in the machinery should be turned by hand to find whether it is running freely. Then all fan and elevator bearings should be greased or oiled. When this has been done, the plant can be set in motion and the speed of the belt-driven fans checked with a revolution counter. If the installation has a continuous drier, the rates of discharge from the drying compartments should be tested. To do this, the drier must be filled to the top of the grain compartments. Then the supply to the elevator should be stopped and the plant run, without the fire being alight, so that the level of the grain in each column can be marked periodically

as it falls. The discharge mechanism should be adjusted until the grain levels fall at exactly the same speed in each column. It is as well also to check the discharge rate at various settings of the control. These adjustments cannot be made, however, until just before the drying is begun, because the rate of flow can vary with the kind and condition of the grain.

If the plant has a furnace that burns solid fuel, the fire chamber should be thoroughly cleaned before the season begins, so that work may start with the fire burning at the correct draught. The air ducts of platform driers should be specially cleaned out before operations begin. If the drier is oil-fired, the burner should be overhauled; if it is heated electrically, the element units should be carefully cleared of dust. The fan blades must run smoothly and the fan casing should be free of dirt. In ventilated silo plants, air leaks must be sealed. Pneumatic conveyor pipes should be inspected, particularly the bends, and any worn or damaged sections ought to be replaced to avoid trouble during the working season. Belt tension on belt conveyors, and bucket elevators should be adjusted, and crank bearings on oscillating conveyors should be checked.

Electric motors are not likely to need any attention other than cleaning and very light lubrication. Excessive lubrication may lodge on windings and catch dirt, and it may even cause insulating material to swell enough for the armature to touch the stator. Chafing of the armature against the stator can also be caused by extreme slack in the bearings, and if play has developed the bearings should be renewed. If a tractor engine is used for power and heat in a ventilated silo installation, it should be remembered that it will be called upon for many hours of continuous running at quite a high power output during the season, and the engine ought therefore to be well overhauled before drying begins.

On grain cleaners, the bolts should be tightened, if necessary, and the screen hangers checked. If the holding-down bolts have to be tightened, it is advisable to try the lie of the machine with a spirit level, because a very slight slope can spoil the performance.

If the beater tips on the hammer mill are appreciably worn they should be turned round so that a new face is presented for work. The whole set of the tips on the rotor should be reversed, otherwise the balance may be upset. When the mill has been running for a while after the tips have been reversed, the nuts holding them in place should be tightened again.

H. J. Hine

Milk and Beef in S.W. Somerset Milk, and milk alone, holds out any hope for the survival as separate holdings of the small marginal farms of the Brendon Hills of Somerset. Store cattle raising as the sole enterprise offers but a beggarly remuneration, no matter how high the standard of management. These are the two conclusions which stand out most vividly from the report* of the investigation into beef store cattle-rearing area of south-west Somerset, carried out in 1952-53 by the Department of Agricultural Economics of Bristol University.

For the purposes of this investigation, a sample group of 33 marginal farms was selected and split into three groups—dairy only, milk and stores (beef), and stores only. The average margin (defined as the money available, after charging unpaid labour, to meet the enterprise's share of general farm overhead expenses and to provide for management and capital involved) per

* Some Economic Aspects of the Beef Cattle Industry in the West of England; Report No. 2. R. R. Jeffery. Department of Agricultural Economics, University of Bristol. 5*s*.

100 adjusted acres devoted solely to the cattle enterprise was: dairy, £736; milk and stores, £602; and stores, £277. If production grants, amounting to £247, are omitted, then all that is left in the last group is £30. The importance of these grants in this type of economy is therefore crystal clear.

Before reaching any final conclusion, however, it is worth while studying the details of the system practised in the store group. The cows were Devons, suckling one calf per cow. Although 47.7 per cent calved in April, May and June, the peak (17 per cent) was in June. Most of the stores were sold at 2¼-2½ years of age, having spent two winters and three summers on the farm. Within this group, a few farms did much better by earlier calving, earlier selling and heavier stocking, but even so, average management in the milk and stores group was more remunerative than a high standard of management in the stores only group. With these and many other figures in mind, the general conclusion is that store cattle-rearing in the area, compared with dairying, possessed almost every economic disadvantage. The disadvantage falls most heavily on small farms, where the alternative to milk production is not store-rearing but eventual extinction.

In the western part of Britain most farms are small and, if the above argument applies generally, then our marginal areas are no sources of beef stores. Accordingly, the report suggests, any expansion of beef store-rearing must come from the arable and mixed farming areas. And these beef stores will be mainly a by-product of milk.

H. Edmunds

Death of Dr. C. S. Orwin We record with deep regret the death of Dr. C. S. Orwin, aged 79, on June 30 at his home in Blewbury, Berkshire. Until his retirement in 1945, Dr. Orwin was Director of the Institute for Research in Agricultural Economics at Oxford University, a post which he had held for thirty-three years. He will be especially remembered for his outstanding pioneer work in the development of this important field of study—something entirely new when the Directorship was created in 1913—and his methods of investigation and analyses of farm costs data. His book, *The Open Fields*, published in 1938, will assuredly stand as a classic authority on the subject of Anglo-Saxon farming. He was also a protagonist of large-unit farming, the arguments for which he marshalled in his *Speed the Plough*, published in 1942. Regular readers of this *Journal* will recall the many interesting contributions which he has made to its pages, the last, in our Diamond Jubilee issue, on the rural revolution of the past sixty years, being not the least of them.

Royal Show Awards At the Royal Show, Nottingham, on July 6, H.M. the Queen presented the Royal Agricultural Society's gold medal for distinguished services to Sir James Scott Watson, formerly Chief Scientific Adviser to the Ministry of Agriculture and Director-General of the National Agricultural Advisory Service. The award, which was instituted in 1933, has been made only ten times, the oldest surviving recipient being Sir Merrick Burrell (awarded 1938).

The Society's silver medal for outstanding contribution to agricultural research was awarded to Mr. F. C. Bawden, Deputy Director of Rothamsted Experimental Station.

IN BRIEF

Hypomagnesaemia

Hypomagnesaemia is a high-sounding name for a disorder which has become increasingly troublesome in recent years. It occurs in both cattle and sheep and means merely low blood magnesium. In dairy cattle the greatest number of cases occur on lush, rapidly-growing pasture in the spring and autumn. In beef animals, recently-calved cows are the principal sufferers, especially where a relatively low plane of nutrition coincides with sudden wet, cold weather. The trouble can, however, occur at any time of the year and in any type, breed or age of cattle, whether at grass or stall-fed. With calves, the disorder is most commonly associated with milk feeding. Among sheep, it is most frequent a few weeks after lambing. Despite a good deal of research, the primary cause of hypomagnesaemia is still unknown. Most investigators agree that, in the adult at any rate, the trouble is not due to a deficiency of magnesium in the food. Neither is there any evidence that liming leads to an increase of it, although there is some reason to suspect that, in certain circumstances, high nitrogen treatment of pasture may do so.

Research into possible lines of the treatment and prevention of hypomagnesaemia is going on.

Pigs on the Pipeline

On Cow and Gate's Hendraburnick Farm, Davidstow, Cornwall, sows and weaners are kept in lined and insulated arks, with runs, in lots of about 50 sows. Creep feed is introduced at three weeks. Weaners are put into a nursery and hardened off under infra-red lamps at first, still on *ad lib.* creep feed. At 12-16 weeks they are moved, in the same batches, to a feeding house and changed slowly on to 2 lb. sow and weaner meal per head per day. *Ad lib.* whey is fed by pipeline and ball-valve troughs at all stages. The whey is stored in large tanks, which are topped up daily so that the whey is cooled and soured before being consumed. The pigs drink up to 4 gallons of whey daily per head. No water is used.

How Strong is the Shell of a Hen's Egg?

The answer is that we know little about it, except that for eggs of the same species there is no relation between size and strength, and that differences in strength can be only partly explained by differences in the thickness of the shell. The Low Temperature Research Station at Cambridge and the Department of Scientific and Industrial Research are, however, looking into it. In an experiment, a constantly increasing pressure was applied to an egg "equatorially" at the rate of 100g. per second.

The results varied, but only about 58 per cent of the variation could be explained by shell thickness. It was found, however, that some shells were harder than others and that about 82 per cent of the variation could be explained by assuming that the strength was proportional to both the thickness of the shell and the hardness of its outer layer. Some unusually thick shells were surprisingly weaker than would be expected. Although the results obtained so far, as reported in *Nature* (May 14) by Dr. J. Brooks and H. P. Hale, on the relation between strength and chemical composition are only suggestive, it is interesting to note that comparison between the weakest and strongest shelled eggs in a batch showed a significant difference in the magnesium content of the shell.

Potato Root Eelworm

Potato experiments (at the Plant Breeding Institute, Cambridge) are aimed at finding varieties resistant to Potato Blight and Potato eelworm, and in connection with the latter interesting progress has recently been made, both here and at Rothamsted. One of the difficulties of eelworm control in the past has been that the cysts containing the eggs are able to lie dormant in the soil over a longish period of years. Then when a new crop of potatoes is beginning to grow in the field and substances known as root diffusates have been released, the eggs are stimulated into life and a new infestation is started. South American varieties of potato (*Solanum tuberosum andigenum*) have now been discovered which, while they produce the diffusates which cause the eggs to hatch, are themselves highly resistant to the attacks of the eelworm. Obviously, then, if this resistance can be transmitted to the European cultivated types, the eelworm menace may be beaten. *Andigenum* itself seems to be a poor yielder, but hybrids from it might be worth using as a cleaning crop, to decrease the population of eelworms in the soil. A further method which may be suitable is to plant an infested field with potatoes, thus stimulating the cysts to hatch, and then to lift the potatoes, leaving the eelworms to die through lack of food.

Ralph Whitlock, The Field

Early Potatoes in Cornwall

The planting of potato seed in early December was shown to be justified on a very warm, sheltered border where, with the high seeding rate used locally, an average rate of yield of 7-8 tons of ware per acre was lifted at the Field Day on May 27, at Suttons trial grounds, Gulval, Cornwall. The performance of stocks from various sources was demonstrated and, for early bulking, Ulster Prince was notably good.

Montagu's Harrier in Scotland

Until 1953 (so far as can be discovered) the only harrier in Scotland was the Hen Harrier, and it is rare enough. In 1953 the first Montagu's Harrier nested in Scotland, on a Perthshire grouse moor. Harriers are long-legged, wide-winged, long-tailed birds of prey. They are like overgrown kestrels, and are not particularly powerful. The male in both species I have named is blue-grey—the hen brown. Both sexes have owl-like faces. They are birds of habit—as indeed are most birds of prey—and return year after year to the same spot to nest. That is why birds of prey generally are specially vulnerable to attack by man.

The Montagu's nest is usually among deep, rank heather. Food consists of small birds (largely meadow pipits), voles, and small rabbits. Larger prey is seldom taken, because the birds are not powerful as the peregrine is. Grouse cheepers are rarely taken, as it happens. At least that was my experience at the 1953 nest. Two chicks were reared in 1953, so we may have the Montagu as a regular breeding species.

David Stephen, Farming News

Finance for Farmers

Information about the ways in which the bank can help farmers financially is given in a useful and well-printed booklet recently issued by Martins Bank. It is free from the Advertising Manager, Martins Bank Ltd., 4 Water Street, Liverpool, 2.

Strawberry Full Circle

In one of a series of articles in the *Review of the Association of Agriculture*, Mr. N. B. Bagenal refers to the wild strawberries which were known to and appreciated by the early nomadic tribes and later by the Roman legionaries as they steadily extended the boundaries of the empire. Among them, they would have found the *Fragaria elatior* or *moscata*, with its musky flavour and carrying its trusses of blossom well up above the leaves. From this characteristic it gained the nickname of " Hautbois".

Much later, the discovery of North America added the famous wild American Scarlet from Virginia and the wild *Fragaria Chiloensis* from the shores of the Pacific to the stocks being assembled in Europe. " With the arrival of these two new species, the whole history of strawberry varieties in Europe took on a new look. Virginiana, with its brilliant scarlet colour and delicate flavour, and Chiloensis, with its thick leaves, vigorous growth and large dark fruits, together set up a new standard of perfection hitherto unknown in Europe. The French botanist Duchesne went to work selfing and crossing them with each other and with European species. His most famous seedling, said to be a seedling from Chiloensis, he named Ananas from its flavour of pineapple, and this was the first of a long line of pine strawberries, some of which survive to this day . . .

" The very latest development of all is to grow strawberries under cloches and Dutch lights, and for this growers are trying out some of the large-fruited hybrids from our old friend the Hautbois which the French and American raisers have been turning out during the last ten years or so. The best known of these are the French Sans Rivale and St. Claude and the American Red Rich. It is too early to say how these will succeed here, but let us not forget the English passion for the old *Fragaria moscata* and hope we may yet see our barrow boys repeating on their barrows the medieval slogans 'Fine Savourys and Ripe Hautboys'."

Myxomatosis in Hares

A British brown hare, killed by a dog at Wilton, Wiltshire recently was found to be suffering from myxomatosis. Earlier in the year the carcass of a mountain hare (also known as the blue or varying hare) was found in Northern Ireland to be similarly affected. This confirms the findings in France that in rare instances the hare may be affected by myxomatosis, but it is emphasized that there is no evidence that the disease affects other animals or human beings. The two cases mentioned are the only ones in which myxomatosis has been confirmed in hares in the United Kingdom.

Few Sheep in Canada

Mr. R. K. Bennett, Chief of Livestock Marketing, Department of Agriculture, Canada, referred recently to the low sheep population of the Dominion. At the present time the figure is around 1½ million—one sheep for every 13 people, comparing with the U.S.A. where there is one sheep to every 6 people: in Australia, the reverse situation shows 15 sheep to every person. The annual consumption of mutton and lamb in Canada is therefore very small—only about 2½ lb. per head: the U.K. figure is given as 24 lb. and Australia and New Zealand 78 lb. per head. Mr. Bennett also stated that Canada imports over 80 per cent of her wool requirements.

BOOK REVIEWS

Life from the Soil. H. F. WHITE and C. STANTON HICKS. Longmans, Green. 25*s*.

Written by two Australians and referring primarily to Australian conditions, this book consists of two sections—the first by Colonel H. F. White, a highly successful grazier, the second by Sir C. Stanton Hicks, Professor of Human Physiology in the University of Adelaide. Their prime object is the same, although the approach is from their individual viewpoints: both are concerned with the preservation of the fundamental asset of mankind—the soil. No excuse need be offered for taking up this theme, for the fact that soil may be ruined by ignorance, greed, or the pressure of economic circumstance cannot be too clearly understood by farmers and townsmen alike. Unfortunately, soil is very much easier to destroy than to maintain in permanent fertility.

Colonel White is at his best when recording the pasture and grazing management that has more than doubled the output of his extensive holding. Many of his successful practices derive from England, and he owes much to such exponents of grassland husbandry as Elliott and Stapledon. The species of plants used and the quantity of seed per acre naturally differ widely from our own, but the principles are the same. He has much to say about the "law of return"—the restoration of the maximum amount of organic wastes to the soil, as distinct from farming with fertilizers, which, in his view, has no permanence. Colonel White is, in fact, an adherent of the organic school, and quotes extensively from the now rather well-worn pronouncements of its better-known practitioners. He joins issue with the superphosphate school of pasture improvement and claims that, although necessary to give young seeds a start, phosphate ultimately loses its effectiveness. Here is a problem which no doubt has not escaped the notice of soil scientists.

Professor Hicks approaches the question from the ecological angle, setting out the relationship between the soil and its living population—from micro-organisms to man. He has no difficulty in illustrating what man can do to his environment—the extreme case being the man-made desert. The almost unnoticed stage at which the pressure of population on the soil can produce deficiencies of plant nutrients, or even of nutritional factors as yet not clearly defined, can have serious effects on the quality of the food produced, and thus on the health and vigour of the community. The remedy, Professor Hicks suggests, is to get more people back on to the land and develop among them a real feeling for the soil. A conservative system involving the return of all organic wastes is to be preferred to blind faith in mineral nutrients. But the reversal of the present-day trend presents formidable difficulties, even for a young country like Australia.

Some parts of this book could perhaps have been condensed without losing the argument; for example, there is a 26-page quotation from the writings of Baron Liebig. Nevertheless, the authors raise important issues which people in general and scientists in particular will have to face up to sooner or later.

H.V.G.

The Inexhaustible Sea. HAWTHORNE DANIEL and FRANCIS MINOT. Macdonald. 16*s*.

Having no index, this book can not be used as a store of facts, so it must be judged on its merit as a book to read once. It is not, however, expounded well enough for its information to be automatically remembered; nor is it written selectively enough to be read for pleasure. Its claim to importance is based on reiteration of the enormous magnitude of mineral and biological wealth in the sea, promising an unlimited resource to a mankind that has reached the limit of terrestrial resources. But it is not interesting merely to have stated in detail what any well-informed schoolboy should already know in general; it would indeed be interesting if the authors could show even one instance of how the unused marine resource could be directed to where it is most needed. For example, how could the unused whale-meat reach protein-starved ryots who have nothing to offer in return? That is typical of the difficulties of using the wealth of the sea. It may be more practicable to use the land properly, and to limit births, than to set raw materials flowing, economically speaking, uphill. Those three processes are of the same kind, deliberate, and there is no escape from their difficulty.

The photographs are breath-taking, especially those by Mirrorpic and D. P. Wilson, but they cannot save the book. Had there been an index, it could have been recommended as a pleasant and up-to-date arrangement of facts.

M.G.

Potato Diseases. ROBERT MCKAY. Colm O Lochlainn, Dublin. 21*s*.

Addressed primarily to those concerned with growing and marketing the potato crop, this book is described by Dr. McKay in his preface as a more or less revised account of the " Diseases " section of the late Dr. Davison's *Potato Growing for Seed Purposes*, while in the foreword it is said to constitute a summary of the discoveries made by the early workers and by Dr. McKay and his colleagues in more recent years. Between them, these two descriptions indicate fairly accurately the scope and limitations of the book, and also account perhaps for a certain lack of balance and some inconsistency of treatment. The references to literature—which are comparatively few—exemplify this. In the sections dealing with fungus diseases they direct the reader mainly to accounts of pioneer work, but in those on virus diseases they are almost exclusively concerned with post-war Irish investigations. This unevenness of handling and the failure to mention any of the many recent developments inevitably detract from the value of the book to the plant pathologist, but will not perhaps matter so much to the grower.

Within its limits, the book is excellent, the descriptions of the symptoms and field development of the various diseases being exceptionally clear and easy to follow. The section on non-parasitic diseases is considerably longer than that in Davison's book and includes some useful pages on frost damage, but it might, with advantage, have been expanded still further in view of the importance of these physiological troubles in the seed potato trade. Apart from a few misprints, the standard of production is high.

Dr. McKay's previous books, also written primarily for those commercially concerned with the crops dealt with, are greatly valued. Despite its limitations, there is no doubt that this book will also be widely sought after.

G.H.B.

Plant Climate and Irrigation. Edited by SIDNEY A. SEARLE. Chichester Press. 20*s*.

If the reader expects to find under this title a fairly extensive treatise on plant climate and irrigation, he will be disappointed. The text is primarily related to the watering of glasshouse crops and, in covering this subject, a number of ancillary matters are dealt with. Mr. Searle's aim has been to bring together several authors on the subject of glasshouse climate, heating, and the watering of tomatoes, and by doing so to emphasize some of the results of recent research in these fields. Throughout the book growers are encouraged to follow this recent research work and take an interest in providing their own establishment with sufficient equipment to enable them to follow and make use of it. Since so often the results of research work are not put into practice, Mr. Searle is to be congratulated on his efforts to keep the glasshouse grower informed in this way.

The first two chapters, " Plant Climate " and " Environmental Factors in the Glasshouse ", should prove extremely interesting to a large number of growers, and the bibliography will be useful to most scientific workers. The chapter on " Growing in a Micro-climate " does not, however, keep up the same standard. A very general background is given to the measurement of soil moisture by electrical methods and by tensiometer, but the difficulties of the latter method are perhaps not stressed sufficiently. Chapter V, dealing with the calculation of crop water requirement, is interesting, but it is felt that this subject has been covered more satisfactorily in official publications, from both the scientific and layman's points of view.

Chapter VI, by P. J. Salter, which considers the effect of different water regimes on tomatoes, is probably the most interesting part of the book, both for the research worker and for the grower who wishes to follow this subject closely. The presentation, however, could have been improved, and a great deal of the minute detail might well have been left out without detracting from the value. The editor helps in the last chapter by reviewing the work of Salter and describes the virtues of trickle irrigation, but insufficient emphasis is given to the need for care in this method of watering, and the effect on sandy soils is not covered. It is also a pity that the last paragraphs in Chapter VII on the role of osmosis are inadequately annotated. If this subject had to be introduced, the nutrition of the plant should previously have been covered in more detail.

These minor criticisms apart, the book has a good deal to commend it. The print is clear and the diagrams and layout good. Indeed, it is a book which most people who obtain their living by growing tomatoes should buy. The amateur enthusiast will also find it interesting, while research workers will discover in it much to stimulate them, if only in disagreeing with some of the more vague passages.

E.R.H.

BOOK REVIEWS

Tillage Implements. G. C. MOUAT and F. COLEMAN. Temple Press. 21*s.*

A book dealing comprehensively with only one section of farm machinery is a rarity. When we have one devoted entirely to the tools for cultivating the soil, and when it is presented in the admirable way that *Tillage Implements* is, then it is welcome indeed. The format is attractive, the appendix and glossary are most useful, and the illustrations are clear and instructive. The drawing of a steam ploughing tackle brings back memories, although one wonders if single-engine sets ever operated to any significant extent.

The preparation of the seedbed—or "root-bed", as the authors would prefer it to be called—is of such importance on any arable field that a thorough understanding is necessary of what different implements can do to produce the requisite tilth in various soils. This book contains a wealth of information of that sort, and it is not merely a description of the separate tools. A careful study of the research and experimental work that has been done on tillage in recent years has obviously been made, and the results are unobtrusively and yet firmly introduced into the text. In particular, the chapter on row-crop cultivations is full of very helpful information on the selection and setting of tool-bars and the tools fixed on them.

Not the least of the merits of this 170-page book are the practical operational tips that are given. It is a pity that the price of the publication may limit its sales among many who would benefit by having it within easy financial reach.

One last thought—Are the things rollers or rolls? Perhaps the authors themselves could not agree; at any rate, both words are used indiscriminately.

C.D.

Farm Buildings (4th Edition). DEANE G. CARTER. Chapman and Hall. 24*s.*

In his preface the author of this book, who is Professor of Farm Structures at the University of Illinois, refers to it as a text-book suitable for students who are taking a one-year course in agriculture, and modestly disclaims any pretentions to teach the kind of planning and building construction required by advanced students. Nevertheless, his book covers a wide field and provides a wealth of technical information which, if swallowed in its entirety, might prove rather indigestible to a student hoping to assimilate it in a single year.

These remarks are not intended in any critical sense. The book is a balanced treatise, covering ground well known in this country, and also giving, naturally enough, the high-powered American slant on the problem of farm buildings. This is particularly noticeable in those pages which refer to the undoubted facilities which exist in the shape of advisory and practical aid provided both by the State Extension Services and by commercial undertakings.

The average American is admittedly "advertisement-conscious"; the American farming community no less so. Professor Carter rightly touches on the use of ready-made buildings and factory-built components, which are accepted generally as part of the American farming pattern. This trend is supported by many enterprising commercial firms, and it is significant that not a few of the illustrations in this book have been drawn from manufacturers' catalogues. It is also encouraging to see emphasis laid on the type of building which can be constructed cheaply and be readily adaptable to changing requirements. It is recognized that high building costs and long distances forbid reliance on building contractors and oblige the American farmer to work out his own problems.

The chapters on construction deal with modern building materials, allied to simplification of construction methods; the reader will notice the important part played by insulation in American buildings. The notes on costs and quantities are most useful in a country where the farmer buys the materials and employs his own building labour. References to brick or concrete are infrequent, because in America timber is cheap and easily obtainable; it is the normal material for all domestic structures. Relaxation of restrictions in Britain will no doubt see increasing use made of soft-woods for farm buildings in the future, and, in this respect, American methods are worthy of serious study.

The illustrations in the book are clear and well chosen. The text drawings are particularly good, and present some useful examples of simplified techniques which our own farm building experts will find it worth their while to investigate further.

Farm management and finance are dealt with in the concluding chapters, which provide a glimpse of the problems of improvements to fixed equipment as seen through American eyes.

F.W.H.

BOOK REVIEWS

Weed Control in Farm and Garden. S. J. WILLIS. Vinton. 8*s.* 6*d.*

Books on the modern techniques of chemical weed control are few and far between, and no book can hope to be an up-to-date guide to practice for very long, so rapid are the developments in this field. This book of 170 pages reviews the problems of weed control and gives due emphasis to the modern chemical techniques. It is written chiefly for the farm institute student, but is also of value to the farmer who wishes to obtain more information on this topic than is usually available in bulletin or booklet form. It is commendably free from mistakes which matter. The photograph of barley ears which are called wheat in the caption is unlikely to confuse the careful reader!

Mr. Willis has provided a useful index, and the book is pleasantly produced. As a review of this subject, it can be recommended with confidence.

C.V.D.

The Evolution of an Insect Society. DEREK WRAGGE MORLEY. Allen and Unwin. 18*s.*

It is becoming increasingly necessary for scientists to translate their thoughts and ideas into simpler terms for people without specialized knowledge. Here is a difficult theme interpreted for the amateur naturalist—an attempt to show the evolutionary development of the Wood Ant, *Formica rufa* L., from its earliest known ancestors.

The work falls into three natural parts. The first, dealing with the evolutionary changes occurring over the last seventy million years, is an intriguing story of increased specialization, such as the tendency of queens to become more prolific and static, the change to a liquid rather than solid diet, and the regurgitation of food to grubs and workers. It is shown how these changes resulted in increased complexity and organization of the community. The many gaps in our knowledge are ingeniously filled by the ideas and hypotheses of the author.

The second section, dealing with the behaviour of " excitement centre " ants, nest odours, fighting and other expressions of behaviour, bears little relation to the broad main theme. Dealing with *F. rufa* as we know it today, it might have been supported by more experimental results to bear out the author's statements.

The final, and by far the most interesting section, is the story of the development over the last twenty years of a community of Wood Ants, comprising five existing and six derelict nests, on a Surrey heath. This is certainly the most convincing part of the book, being based on the author's own observations.

There are, unfortunately, many minor irritations to the reader. Too many digressions from the point under discussion appear, are partially developed, and are then left till a later chapter. A number of surprising terms are found. Will many readers readily accept " un-Wood Antish ", " antishness ", " nerve cellness ", and the like? The book is profusely rather than well illustrated, though Harold Bastin's photographs are of a uniformly high standard. A number of the plates would have been much better incorporated into the text as line drawings. Others are very poor; for instance, Plate 11, a chart made up of photographs of ant specimens (too small to show any detail) to illustrate family relationships, needs 211 words of explanation in the legend!

The overall impression left is that the author has chosen a splendid theme for presentation as popular science but has not quite succeeded in getting over the story in a straightforward and succinct manner.

J.H.W.

Balanced Steaming of Glasshouse Soil. (John Innes Leaflet No. 14). Oliver and Boyd. 1*s.*

The results of four years of research into the technicalities of soil sterilization by steam are embodied in this leaflet. The workers at the John Innes Horticultural Institution have the advantage of being able to carry out their investigations under full-scale practical conditions, and their findings are set out simply and in a way which the practical grower can understand.

The leaflet describes the John Innes concept of " balanced steaming ", which is claimed to be the only method of combining high thermal efficiency with minimum labour costs. By balancing the full boiler output against the area being steamed, the necessary low " pipe " pressure and low injection rate are automatically ensured, without the need for a reducing valve.

No grower who uses steam for soil sterilization can afford to miss this booklet.

E.S.

BOOK REVIEWS

The Fruit Year Book. Royal Horticultural Society. 10*s.*

In conformity with its seven predecessors, the 1955 *Fruit Year Book* is a well-produced, skilful symposium of historical, scientific, practical and domestic information of interest to all concerned with fruit growing. The Rev. C. L. Dunkerley would no doubt be saddened if he felt he had inspired even a little envy or covetousness in his readers, but his excellent descriptions of some of the superb fruit books of the early nineteenth century make us wish they were not so scarce or so expensive. Mr. J. Wilson's notes on apricots should inspire gardeners and scientific workers to concentrate on bringing this succulent fruit back to our gardens—the factors limiting its popularity would not appear to be insurmountable. Indeed, the contributions on fruit drop in apples by Dr. Luckwill and the maintenance of healthy fruit clones by R. V. Harris remind us of the immense amount of effort now concentrated upon research into fruit problems. Dr. Luckwill's article, indicating promising lines of action to regulate the fruit drop, encourages us to hope that before many years this hazard of the fruit-grower will no longer be of much significance.

The owner of the small garden is not forgotten in this issue, which should be read with as much interest by the amateur as by the professional grower of fruit.

R.H.

Bushel, Half-bushel, and Quarter-bushel Boxes. (British Standard: 2586: 55). British Standards Institution. 2*s.* 6*d.*

This standard, which was prepared at the request of the Ministry of Agriculture, is one of a series on the various kinds of containers used for horticultural produce. It specifies dimensions and certain constructional details relating to each of the three containers, and sets out in detail the actual measurements of ends, sides, bottoms, and corner posts or end battens, whichever are used. It recommends that the boxes shall be made entirely from softwood, or from suitable home-grown hardwoods—for example, poplar. Details of wiring and nailing requirements are given and each container is illustrated.

In dealing with construction, alternative methods are suggested for the bushel box. Thus there may be a space between the two boards forming the end, or the two boards may be close together, as agreed between purchaser and manufacturer. The reason for this alternative is that, while the market gardener may prefer a box with end boards together, the fruit-grower requires a space for ventilation.

The publication of this standard is supported by the box manufacturers, and it should now be a simple matter for the purchaser to specify his needs and to ensure that, by quoting this standard, subsequent orders result in the boxes delivered being of similar size—an important point for any organization using pallets.

Copies of the standard may be obtained from the Institution at 2 Park Street, London, W.1.

W.H.S.

Long Ashton Research Station Annual Report, 1953. 15*s.*

Progress in the investigation of the problems of fruit production, cider and fruit juice manufacture, the domestic preservation of food, micro-nutrients, and willows is reviewed in this annual report of the Long Ashton Station. Much of the report is devoted to detailed accounts of research. These contain many interesting points which bear directly on the practical problems of the grower and manufacturer. For example, mention is made of a new dessert apple (Exeter Cross) which is earlier than Worcester Pearmain. Again, in tests of a chemical ripening agent, apples of good quality were marketed twelve days earlier than normally as the result of spray treatment in July and August. In other work, gooseberry cuttings planted in late September proved more successful than those planted in August, October or November.

The separate papers include those dealing with apomictic seedling rootstocks, which, in theory, should be cheaper and freer from virus infection than clonal stocks; rubbery wood virus; the relation of chemical structure in insecticides and fungicides to their biological activity; and a survey of perry pears in north-west Gloucestershire. There is, too, an interesting series of reports on fruit tree spraying problems, which give, *inter alia*, comparisons of hand lance spraying with low-volume and air-flow spraying by machine, and include some interesting data on the effect of using with the latter dilute instead of concentrated insecticidal materials.

A.J.L.L.

BOOK REVIEWS

Fruit from Trained Trees. S. B. WHITEHEAD. Dent. 10*s.* 6*d.*

There is a good deal to be said for drawing together in one book information on the training of fruit trees in restricted forms and for limited space, and the subject will particularly appeal to home gardeners with too little room for bush or orchard trees, or who want crops within the shortest possible time from planting.

A lot of ground is covered and much good sense and information packed into these pages, but now and then the emphasis is in the wrong place or the prime essentials for success or failure are not brought out clearly enough. Too little is said about the problems of cordon and pyramid tree growing, and some of the practical details of pruning and management are glossed over or inadequately set out, especially for the inexperienced newcomer who would seem most in need of instruction on the very specialized techniques used.

A comprehensive list of diseases and pests is dealt with, but it could be made more useful by always including the details of the correct time to apply and the recommended strength of insecticide or fungicide. More serious, there is a quite inadequate warning to the home gardener of the desperate risks he may run by introducing potent systemic and persistent poisons to the innocents at home or allowing spray to drift over the party fence to the danger of the unsuspecting " semi-detached's " next door.

R.T.P.

The Vale of Pewsey. (Regional Books Series). H. W. TIMPERLEY. Hale. 18*s.*

Although not strictly an agricultural book, this recent addition to the Regional Books Series will appeal immensely to all lovers of the countryside, and particularly to those who know this very rural part of our Wiltshire county. Description of the views in and around the Vale are so vivid that the reader might well be standing on Milton Hill or Martinsell on a summer's day with the Vale at his feet.

The Vale of Pewsey, stretching from Devizes in the west to Burbage in the east, and lying between Salisbury Plain and the Marlborough Downs, is unlike most valleys in that it is a downland valley. It has no river flowing from one end to the other, but two sources of the Salisbury Avon converge from each end and combine to flow through a gap in the Downs of Salisbury Plain away to the south. Many of the attractively named small villages which nestle so naturally into the Vale are described in detail in this book, and there is an interesting chapter on the disused Kennett-Avon Canal, which runs through the Vale. There is also much to interest those who are keen on wild flowers and birds.

The book is well presented and is illustrated with 25 excellent photographs, which depict very truly this beautiful stretch of fertile country. There is also a sketch map at the end, which is more than many books of this type possess, but I do feel that a description of a part of the country such as this would benefit by the addition of a clear, scale map showing the contours. This, however, is my only criticism of a book which is a first-rate account of one of the most tranquil and charming parts of the British countryside.

A.H.V.

Weed Seeds as Impurities of Agricultural Seed. National Federation of Young Farmers' Clubs. 2*s.* 6*d.*

Under this title, the National Federation of Young Farmers' Clubs has prepared a revised version of *The Impurities of Agricultural Seed*, by Parkinson and Smith, which was published in 1914 and has long been out of print. It contains the descriptions and photographs of 92 weed seeds, arranged in botanical families and with names in Latin and English; there is also a short introduction, taken from the original edition, on how to identify weed seeds.

The descriptions are accurate and concise, with a minimum of technical terms, and the photographs show clearly the shape and surface features of each seed, although they may be misleading for size unless differences in magnification are taken into account. The booklet is paper-backed and of a convenient size for the pocket. It should be a valuable aid for those who have no specialized knowledge of seed analysis but who are none the less interested in identifying those weed seeds which commonly occur in agricultural seed.

P.S.W.

BOOK REVIEWS

Commercial Mushroom Growing. M. H. PINKERTON. Benn. 21*s.*

Mr. Pinkerton, who must be one of the most colourful and best known personalities of the mushroom industry, writes as a commercial grower for commercial growers. It is a pleasure to find a book on mushroom growing which does not try to widen its sales appeal by saying what an easy and profitable hobby mushroom growing is for amateurs.

The book itself is a curious mixture; it is planned on sound lines to cover all the essentials of commercial growing, with no fancy theories, but its value as a practical handbook is reduced by some omissions and some statements which seem to differ from most current opinions. A criticism which might be levelled by British readers is that too much of the material is based on American practice, particularly in the chapters describing buildings and composting, and in the names of some of the insecticides and fungicides.

After a chapter on the life history of the mushroom, normal and short methods of composting are described, British and American formulae for making synthetic composts are given, and there is some practical advice on peak-heating. Other chapters deal with casing soil, watering and house management during cropping, packing, hygiene, and pests and diseases. The tray system is described, with suitable emphasis on the importance of maintaining a regular schedule.

A critical reader might be irritated by too many ambiguities and minor faults in writing and presentation; it is surprising that some of these escaped notice by both author and publisher during proof reading. Some of them are serious and could mislead inexperienced growers, who are the readers most likely to rely on the book for guidance. For example, in the chapter on mushroom houses, the author gives a detailed cross-sectional plan of an American-type house, without any indication of its length or the cropping area which it contains, yet he gives the cooling capacity needed for a " standard house". The length and cropping area of a typical house are mentioned more or less casually in other parts of the book.

On casing soil, he suggests typical rates of liming per acre of ground, but does not give corresponding rates per ton of soil—the form in which most growers would need the information. And on watering he mentions the use of power sprayers and watering cans, but not mains water, which is surely the most satisfactory. It is also surprising to find " Flies " distinguished from " Insect Pests ", with the latter title including mites and eelworms.

With alterations in detail of the kind mentioned, a second edition of this book could be very much more useful to the commercial grower.

R.L.E.

Commercial Chrysanthemum Culture. J. E. CURWOOD. Benn. 15*s.*

The regular appearance of new books dealing with chrysanthemum growing is an indication of the great popularity of this plant, both with the amateur and commercial grower. Apart from possessing all the qualities needed in a cut flower for market, the growing of midseason and late-flowering chrysanthemums can be made to fit into the rotation with tomatoes—the main glasshouse crop in this country.

As with a large number of horticultural practices, the cultural routine followed by commercial chrysanthemum growers has been developed by trial and error over a long period, following sound and detailed observation. Mr. Curwood outlines the best of current commercial practice in chrysanthemum growing along the lines established by tradition, and there is no doubt that if his recommendations are faithfully followed, then excellent results will ensue.

Knowledge of the physiology of the chrysanthemum has increased enormously over the last two decades, and it is now possible to give scientific reasons for many of the routine commercial practices, or to make alterations in them, as necessary, without jeopardizing the crop. Particularly, the effects of day-length and temperature are of prime importance and should be broadly understood by the chrysanthemum grower. I should like to have seen a chapter outlining these effects in simple language on the same lines as the excellent one on " Watering and Feeding ". Applying the author's own words, " seeking out reasons rather than using conjecture " to the all-important matter of the chrysanthemum's response to its environment, would help growers to understand the reasons for some of the stumbling blocks of stopping, budding, etc., that can so easily confuse them.

Altogether, the book contains a lot of sound, practical advice and will serve as a useful guide to anyone setting out to grow chrysanthemums along traditional lines. Regrettably, the photographs are not up to the standard of the text.

K.D.B.

BOOK REVIEWS

The Lily Year Book, 1955. Royal Horticultural Society. 10*s.*

Lovers of lilies will welcome the new and excellent volume published by The Royal Horticultural Society under the editorship of Mr. P. M. Synge and Mr. L. Roper. This year's offering contains a great variety of articles, varying from experiments on propagation to the hunting of lilies in California, and from fritillaries to hints on where and when to plant lilies in an average garden. There is indeed something here for the amateur as well as for the professional.

Readers will be particularly fascinated by the report on lilies and allied plants found in Burma by that intrepid explorer F. Kingdon-Ward, while those who have had the privilege of going to the Savill Gardens at Windsor will be grateful to T. H. Findley for reviewing the lily species and hybrids which have been flowering there during 1954. Mary G. Henry writes attractively on "Lilies in my Garden", and deals in particular with the North American lilies. There is also a report of a most interesting lecture on the same subject by Ellen K. Field, and the discussion that follows this report is most illuminating.

The whole book is beautifully produced. It is well illustrated with some eighteen or nineteen plates, and efficiently indexed.

W.E.S-C.

Yearbook of Food and Agricultural Statistics, 1954. Part 2, Trade. F.A.O. 17*s.* 6*d.*

The second part of F.A.O.'s two-volume year book summarizes in some 350 pages, and in three languages (English, French and Spanish), all the information available up to the end of 1954 on the value and volume of the world trade in agricultural products. The information is based on the answers to questionnaires sent out by F.A.O. to 41 nations and on official publications of the countries concerned. Besides pure food crops, it includes commodities such as fibres, rubber, forest products, fertilizers and machinery. There is also a section dealing with the imports and exports of certain non-reporting countries, particularly China, the U.S.S.R. and those in Eastern Europe.

The companion volume, concerned with world production, land use, population, livestock numbers, etc., was published earlier this year. Both publications are obtainable from H.M. Stationery Office, P.O. Box 569, London, S.E.1, or through any H.M.S.O. Sale Office.

Annual Report of the National Federation of Young Farmers' Clubs, 1954.

The multifarious nature of the activities of the National Federation of Young Farmers' Clubs is clearly brought out in the recently published report for 1954. The achievements of the year are described as being "solid rather than spectacular", but it is interesting to note a further considerable increase in membership to just over 67,000, organized in 1,532 clubs. The accounts show expenditure to be running at the very high figure of over £26,000.

Copies of the report may be obtained free from the Central Office of the Federation, 55 Gower Street, London, W.C.1.

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